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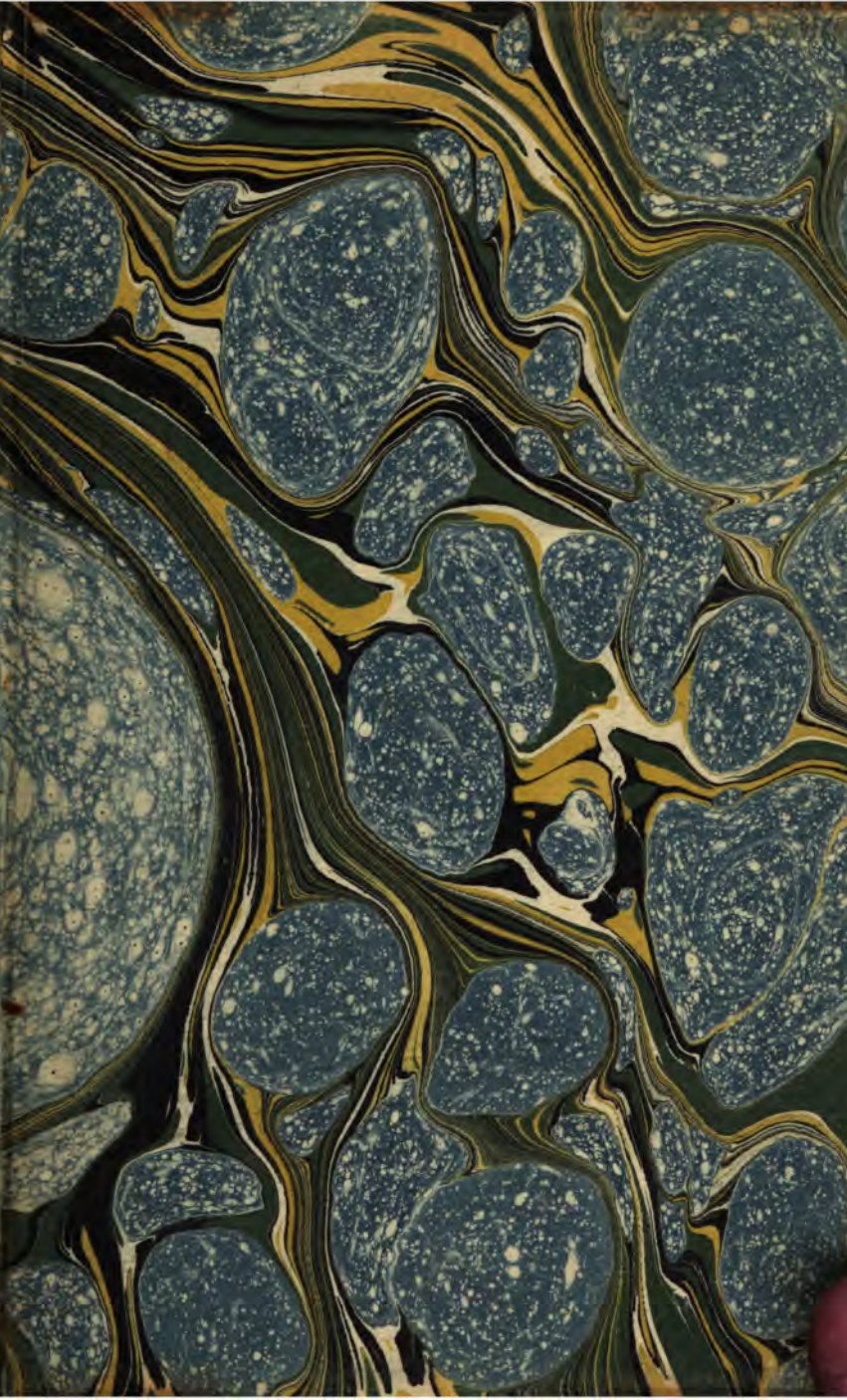
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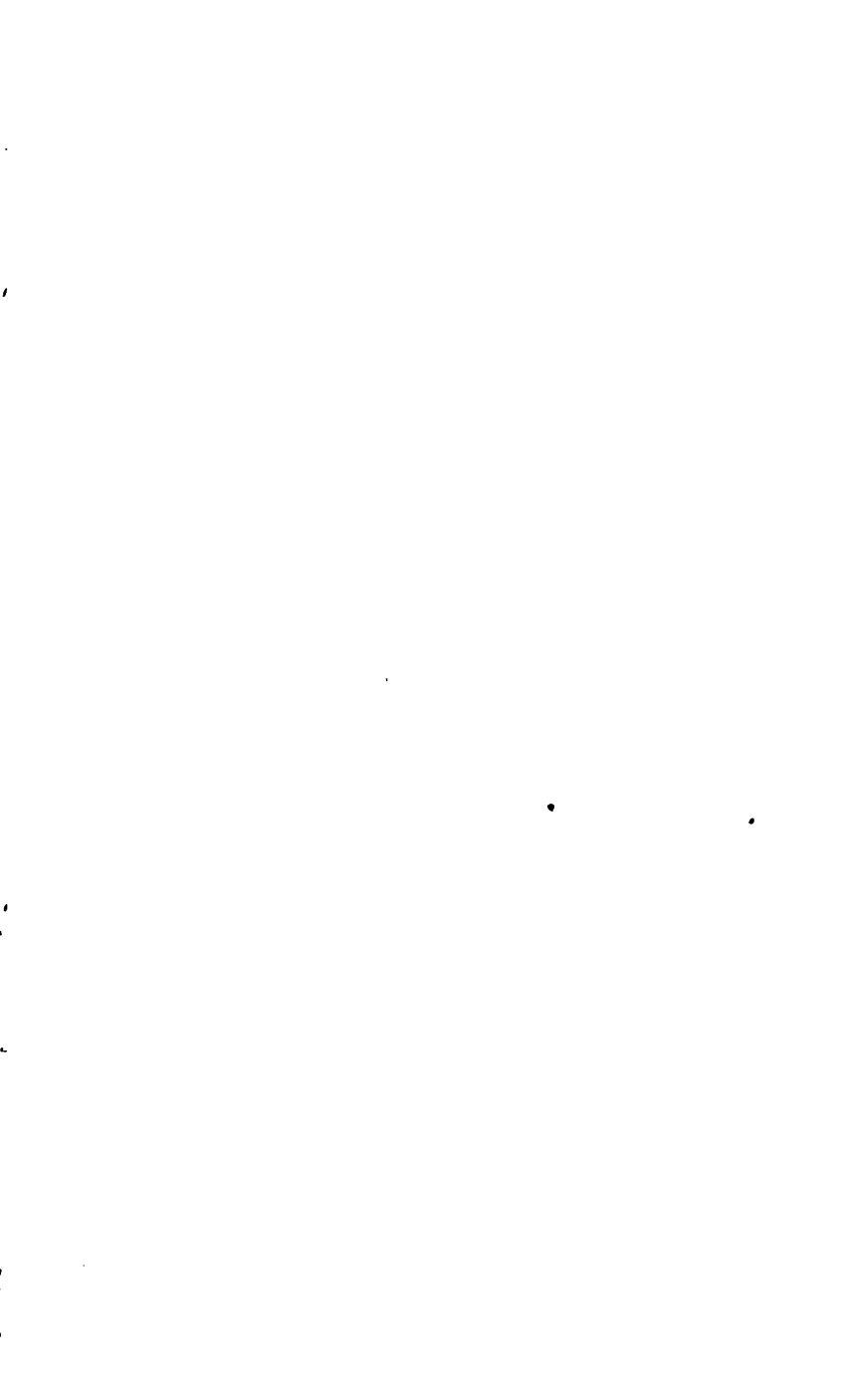
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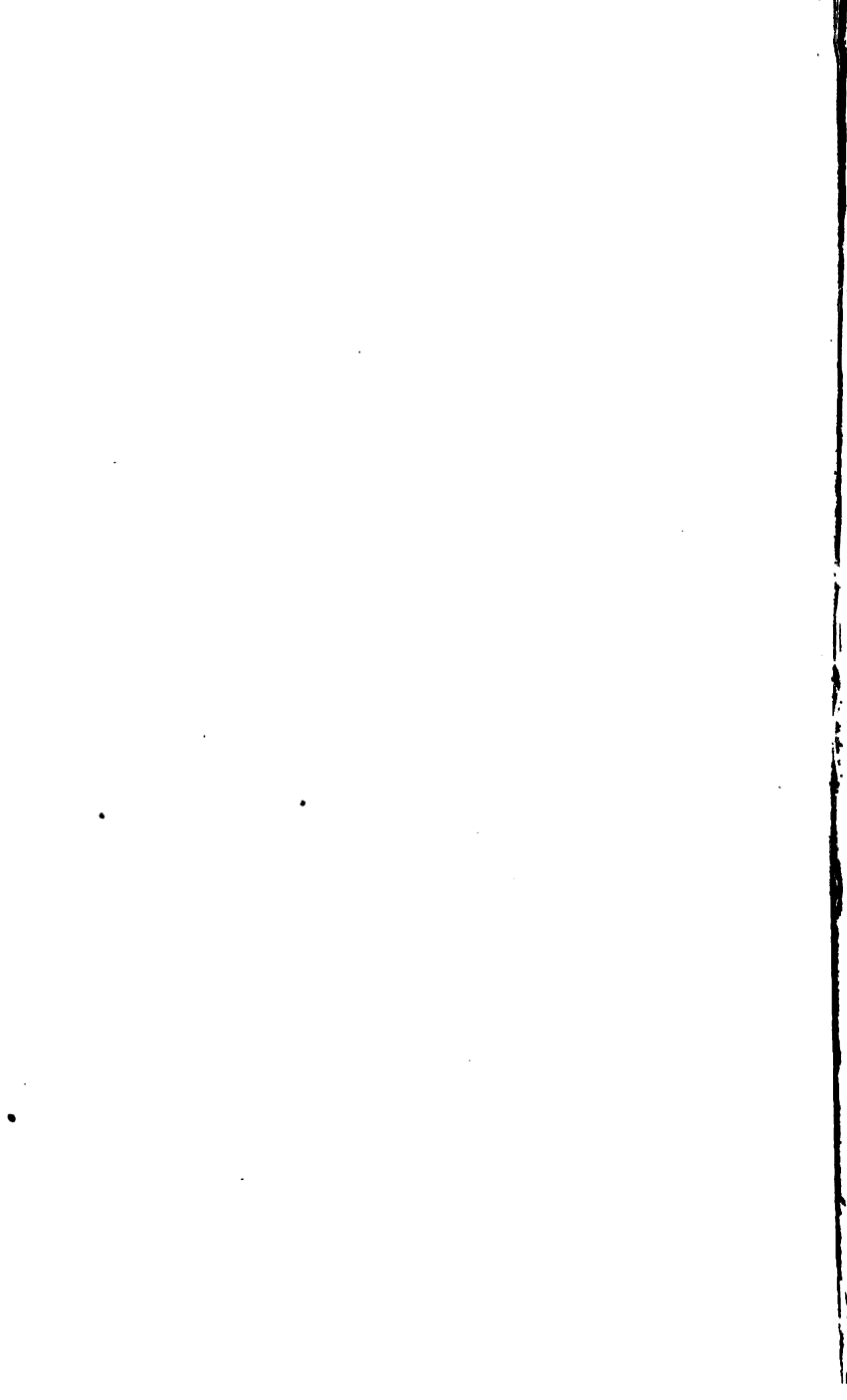




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AN
ACCOUNT
OF THE
STOPPING
OF
DAGGENHAM BREACH:

With the ACCIDENTS that have attended the
same from the first UNDERTAKING.

CONTAINING ALSO

Proper RULES for performing any the like
WORK: And PROPOSALS for ren-
dering the Ports of DOVER and DUBLIN
(which the Author has been employ'd to Survey)
Commodious for Entertaining large SHIPS.

To which is PREFIX'D,

A Plan of the LEVELS which were over-flow'd
by the BREACH.

By Capt. JOHN PERRY.

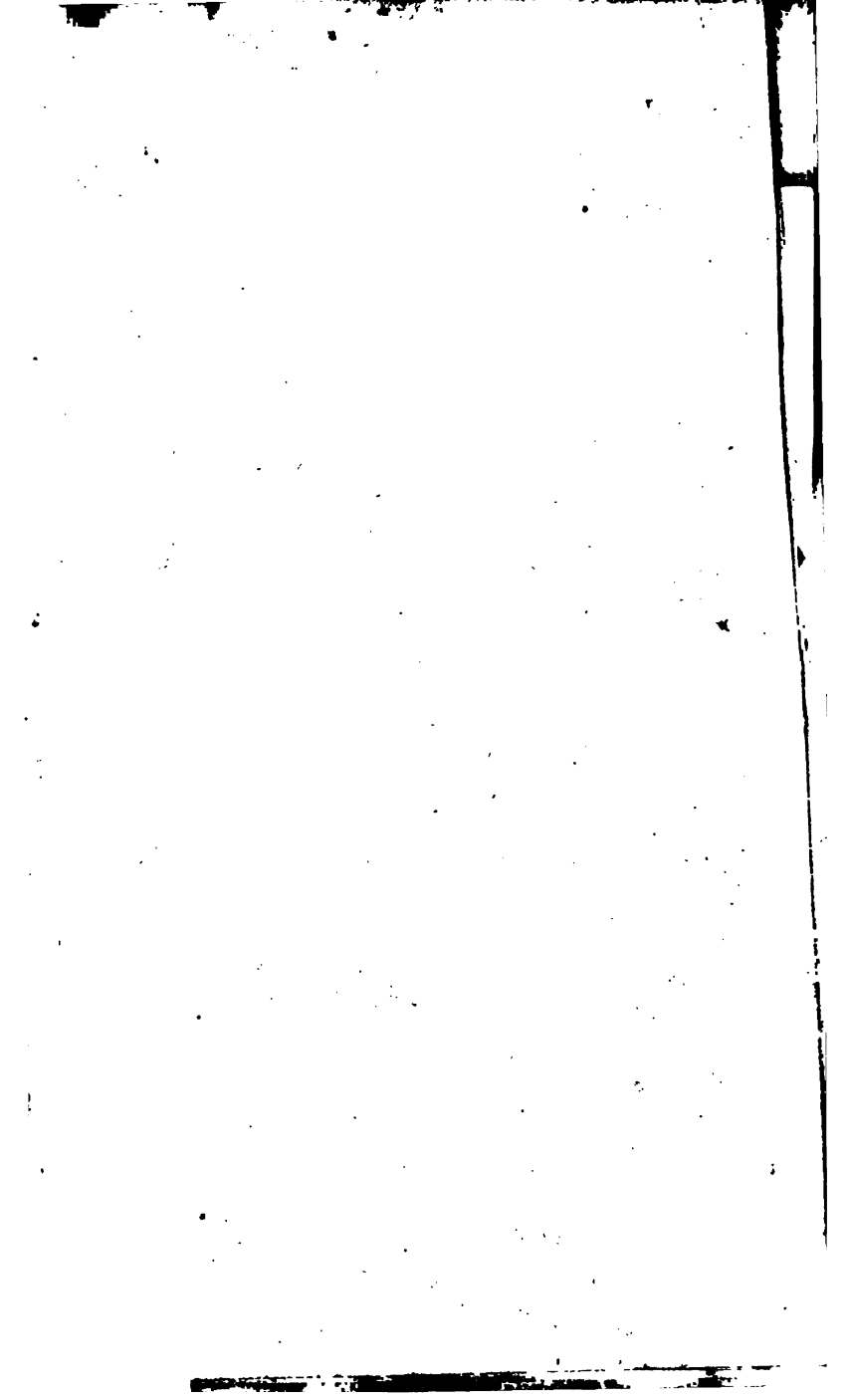
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A N
A C C O U N T
O F

Daggenham Breach, &c.

THE Work of **Stopping** of this Breach after the many wearied and unsuccessful Attempts of the Land Owners; until they had expended more than the Value of the Land, and given it wholly over as Impracticable; being then deem'd worthy the Consideration of the PARLIAMENT of ENGLAND, for Preserving the NAVIGATION of the THAMES: And being generally look'd upon as a Thing tending to the Publick Good, it having been more the common Discourse of Men in Conversation, and more Propositions and Schemes Projected and made, both to the

Trustees and otherwise, than I believe was ever before known in the World, relating to a Work of such kind: And finding by the constant resort of People down to the Breach, in the carrying on of my Works, as well Persons of Distinction as others, that there Remains still a particular Curiosity in the Minds of Men to see, and be Inform'd of this Matter, and being at the same time very sensible, by the Expressions to me, and Questions which are daily ask'd me, particularly since my last stopping the Breach, and by the Rumours about the Town, that ill grounded Notions have been suggested and taken place, with regard to the unhappy Accidents which I have met with, I will therefore, as well for the giving my self some Ease in the answering such reiterated Questions which are put to me, (by almost every one I meet) as more particularly for the better Satisfaction of such Persons, who may be able to make a Judgment of the Truth of what I relate, give the following Account of Matters, as far as I know and have been concern'd in this Affair.

AND that I may give such Gentlemen who shall favour me with the perusing of this Paper, the best and plainest Light in the whole thing, that I can;

I shall, *First*, speak of the Nature and Extent of the Breach.

Secondly,

Secondly, shall point out the **Respective Places** (as in the Plan hereto prefix'd is laid down,) and **Manner** in which the several Attempts before me were made.

Thirdly, Shall show the **Reasons** which at the first induced the Right Honourable the **TRUSTEES** appointed by Act of Parliament, to reject the Proposals which I made to them, and to agree with *Mr. Boswell*: And afterwards the **Occasion** which made them come to the **Unanimous Resolution**, of Treating and Contracting with me; together with the **Difficulties** and **Misfortunes** which have accompany'd me in my Proceedings.

AND first, As to the **Nature** and **Extent** of the **Breach**: It was occasion'd by the blowing up of a small **Sluice** or **Trunk**, made for the **Drein** of the **Land-Waters** in the **Banks** of the *Thames*: And might, if proper and immediate **Help** had been apply'd, have been easily stop'd with a small **Charge**; the **Ditch**, or **Drein**, of the **Marsh Grounds**, which led to such **Sluice**, being at the first blowing up of the **Sluice**, not above **fourteen** or **sixteen** foot broad, and might, in a **Day** or **two Days** time, have been easily stop'd, by the bringing on a small **Dam** in **Form** of a **Semi-circle**, to the *Thames* **Wall**, if many **Hands** had been set to it, but through the **Neglect** thereof, the constant **Force** of the **Water** setting in and out of the **Levels**, soon made the **Gap** wider, and when it once came down to the **Moor-logg**, **Gravel** and **Sand**, which lies but a little way below

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the common Surface of the Levels, the Water then gull'd to such a depth, and took such Power, that there was no Remedy found for the mastery of it.

It is now about Fourteen Years since the Breach happen'd, and it has in that length of Time worn and spread it self into several large Branches, like the natural Arms of a River, by the Force and Fall of the Water, returning from off the Marsh Ground upon every reflux of the Tide; the longest of which Arms is above a Mile and a half in Extent, and in some Places is 4 or 5 hundred Foot in breadth, and from twenty to thirty or forty Foot depth. There is by Computation, about a hundred and twenty Acres of solid marsh Ground, wash'd into the THAMES, in manner above mention'd, the Surface being compos'd of clayie Ground, the next Moorlogg, then about a Foot or fifteen Inches blue Clay, and afterwards Gravel, and a sort of Quick-sand, as it has been esteem'd by the Undertakers before me, but I have found no other than common Gravel and Sand.

This Sullage, take it together, which has in the Course of the above time been torn and driven into the River, has first, that which has been the heaviest Part of it, been more immediately lodg'd without the Mouth of the Breach, and in the adjacent Reaches above and below, but that which has been of less Ponderosity, has been carried to a greater distance,

It may perhaps seem somewhat strange, that I mention the Matter of this Sullage, that has
been

been discharg'd to have been carried above as well as below the Breach, whilst the same has been driven out by the Tide of Ebb only: But whoever considers, that in the windings of a River, where there is a Flux and Reflux of a Tide, in many Places where there is an Eddy, and Matter subsides upon the Tide of Ebb, there is again a strong course of a Current upon the return of the Flood which sets the other way, will consequently make no difficulty to believe, especially considering the great Quantity of Matter thrown out by the Breach, that the Reaches upwards in the River, have suffer'd as well as those below; and I have been inform'd, that since the Breach happen'd, there has been found considerably less Water above in WOOLWICH Reach, where the Men of War have their Moorings.

How Detrimental this has prov'd to ERITH, and other Reaches, I shall not protract this Discourse by laying down, but shall add, that whatever Sullage has not been lodg'd within the River, as some Banks have been known to be thrown up since the Breach below GRAVES-
END, the rest it is certain has been carry'd out without the Mouth of the THAMES, where the Stream when it forsakes the Banks spreading and loosening its force, the strength of the Current ceases, and being met by the continued direct rolling in of the Waves of the Sea towards the Shoar, as is the Case of all Barr Places, there subsides, (that which is not so very light as to float away into the main Sea) and distresses the Entrance into
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the Port; and tho' the encrease of such Sullage or addition to our Sands or Flatts, may not perhaps be much observ'd or minded in one Age, or the Memory of one Mán; yet by the common Wear of the River (parallel to the Proverb, that a continual dropping wears the Stone) it may in the course of Time, it's too much to be fear'd, be felt. I will therefore conclude this Point with this Observation, that in all Nations who have regard to Trade, where the Rivers are not bounded with Rocks and stoney Ground, and have deep and clear Water in the Passage, but otherwise (as in the THAMES) are shallow by Scituation, and Subject to the Lodgment of Sullage, either wthin or without at the Entrance, such as are subjected to the continued wash and wear of their Banks, &c. and are called Barr Places, there are strict Laws made to prevent the throwing out of any Ballast, even to a considerable distance at Sea, or the discharge of the least Sullage within, whereby any way to annoy their Rivers.

And if I am not misinform'd, there is a Law of Ancient standing now in Force in the THAMES, that whatsoever Ship is observ'd to heave overboard but a Shovel full of Dirt into the River, shall pay five Pounds, and I hear likewise that there has been formerly an Act made by the Lord Mayor, Aldermen and Common Council of the City to put a Restriction upon the bringing of Sand any more into the City of LONDON, by reason that great part thereof is constantly

constantly wash'd into the River, but it seems the Female Power prevailing in this Affair, the said Order is become entirely neglected.

Further, Whoever will but have the Curiosity to observe the Sediment in one Bucket of Water, taken up at the BUOY of the NORE, at the last part of the Ebb, when the Current sets out of the River, and another at high Water, when the Flood sets in, will find abundantly more Sediment in the Bucket, taken up upon the Ebb every Return of the Tide, even in the calmest Weather; and as it cannot thereby be denied, but that there is a continued Out-set of Sand and Matter, discharg'd by the Mouth of the THAMES for ever, so the Passage called the FLATTS, from thence to the DOWNS, in which so many Ships with their rich Ladings have been known frequently to be lost, as well outward as homeward bound, and none of the Men ever heard of, but have perished with the Ships, may in length of time be concluded, will still prove more dangerous and difficult for Ships, which there are too many Instances in the World, (as the Port of CHESTER may be named for one) where Navigation has within the Memory of Man been evidently render'd worse. And although it be true, there has been a time known in a late Reign (as has been objected to me on this Head) when by the removing of our Buoys and Sea-Marks, our Sands were serviceable to us, by rendring the Passage of the Enemies Ships dubious and impracticable; yet I hope that is

no reason at all, nor never will be, why we should be contented to have our Flatts or Sands, which are as the Barr to our Port, increase more than they are, wherever it is in our power to apply the least Remedy to prevent it.

I chuse to be the more particular upon this Point, because I do not know when any Persons have, or may make it the particular Business of their Lives to extend their Thoughts this way: And because all Breaches (the Matter which I am now treating of) must certainly be attended with a considerable Discharge of Sullage into the River; and it being a thing well known, that whatsoever Breaches happen in the THAMES, are generally occasion'd not from any Damage of the Tide's washing down or running over the Tops of the Banks (or Walls) in such places where the Marsh-Ground lies equal on the Inside with the Foot of the Walls, which happens to be overflow'd, but from the bad Workmanship, Decay or Defect of the Sluices or Trunks which are made for the Drein of the Levels; of which I shall only mention those, which within a narrow space of Time have happen'd, as this of DAGGENHAM Breach, that upwards of Forty Years since at LIMEHOUSE, that more lately at WEST-THORROCH or LONGREACH, about two Miles below PURFLEET, which continued more than Seven Years before it was stop'd: again, there has been another Breach, which happen'd by the blowing up of a Sluice in the Levels of DAGGENHAM Beam, not three Years and a half since (at Lett. F. in
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the **PLAN**) as likewise there has been since I have been concern'd at **DAGGENHAM**, two or three more Places, particularly one not above half a Mile to the West-ward of me, which has been in imminent Danger of a new Breach, by the defect of a Sluice made of Wood, (a prevailing Custom in **ENGLAND**) which are generally very unsecure and unskilfully plac'd, and the Navigation of the River, thereby still frequently liable to suffer in less or greater Measure.

Therefore, with all Submission, I think it would be good for the preventing of future Breaches, that there should be a Law made, to oblige such Gentlemen who have their Estates on the Banks of the **THAMES**, to make all their Sluices with Stone cemented with Tarras, especially in those Levels which are of large Extent, and not easy to be redeemed when a Breach is made. The Reason why Gentlemen have never yet made their Sluices of Stone, and the Custom of making them of Wood, has prevail'd in **ENGLAND**, is, I believe, through one of these two Reasons, or rather both of them together; as first, That Men in **ENGLAND** have perhaps something in them of the humour of another Country that I have been in, and are not very willing to depart from the way of their Fathers; and Secondly, Because the Ground on the Banks of the **THAMES**, is, by the Workmen employed, esteem'd bad for fixing the Foundation of Sluices, and that the Weight of Earth, necessary for making the Banks, or Walls, where such Sluices

or Trunks are requir'd to be fix'd, usually subjects them to rack and settle down at the Foundation, which is certain would be directly evil in the case of Stone, as well as it is too often followed with danger of Leakage and Destruction, when made of Wood, in the manner as practis'd in the THAMES: but let the Foundation of such Stone Sluices which I propose, be fix'd after the manner which the *Dutch* have built their STADT-HOUSE at AMSTERDAM, and other their Buildings in HOLLAND, and there cannot possibly be the least settling in the cases of such Sluices propos'd of Stone, but (humanly speaking) they will endure thousands of Years, with very inconsiderable Expence or Trouble, after once made, in the maintaining them in repair for ever: Whereas Sluices made of Wood (especially that Part which lies neither wholly wet nor wholly dry) must continually be subject to moulder and decay; and always require, some in twenty, some perhaps in thirty or forty Years, the repeated Expence of new building such Sluices: Besides, the never being free from the Suspicion of Leakage and Danger, making thereby the Estates of such Gentlemen who have them in Possession the less valuable in the common Esteem of Mankind, and it being practis'd both in *Holland* and *Flanders*, to build all their Sluices with Stone, or a sort of Brick made for that purpose equally durable in the Water. Therefore why may it not be as reasonable to put a Restriction upon the Building of Sluices with Wood in *England*, to prevent

prevent Mischief from the Inundation of Water to the Navigation of the River, &c. As there is a Law made to Establish a Method for the Building of Houses, to prevent the spreading of destruction by Fire. I shall next proceed to show the respective Methods which the Persons who practised before me have went on with, in their attempts to stop the present Breach.

ABOUT a Fortnight after I came over from RUSSIA, in the Year 1713, a Gentleman who was concern'd in the Endeavours which were then carrying on at the Expence of the Land-Owners came to me, and desir'd me to go down with him and see the work which they had then advanced near to a close as he told me.

I readily waited on this Gentleman believing by the Character which he had given me, that the Work was brought near to the being finish'd, and resolving to have given him, with the rest of the Land-Owners concern'd, what help I could as to my Advice and Opinion in it, had I seen it Practicable to make it effectual in the manner it was begun.

AT my arrival on the spot, I found upon the Larboard, or West side, going into the Mouth of the Breach, a small Sluice going then to be placed, of about three Foot depth, and six Foot width, in the Area or Passage, for the Water, and that the Canal which was dug for placing down the Sluice, was not above three Foot and a half depth below the Surface of the Marsh Ground.

UPON

UPON my observing of this Sluice which was design'd to be plac'd at no greater depth, nor of no greater dimensions, I therefore, as I had above resolv'd, without any Reserve, told the aforesaid Gentleman, that in order to give the greater vent and Ease, to the Passage of the Water in the Endeavours to stop the Breach, I thought it would be proper to have had such Sluice placed both to a greater depth, and of much greater Dimension, but in justification of the placing of such Sluice as it was begun, he reply'd to me, that it was not the Custom of the River to make Sluices usually so large as that was, nor thought safe by Workmen to venture to fix them any deeper, on account of the Moorlogg and bad Ground, which made it esteem'd to be Impracticable. But these Reasonings have since been confuted; in the Practice of placing my Sluices to the depth of the ordinary Low Water Mark, (or very near it) as well as Breadth proportionable thereto, being more than thirty times the Dimensions in the Area, and on account of the Depth only, I am sure a Thousand times more serviceable in stopping the Breach, than the foresaid Trunk or Sluice, which they proceeded to fix, could possibly be found.

BEING conducted by this Gentleman farther on to the Work, where they were endeavouring to stop up the Breach, and being particularly informed by him of what they had done, in the various Attempts made for it, with what they were then further resolv'd to put in Practice:

Practice: And having sounded the Depths of the Breach, and examin'd what I saw needful, it made me then change my Mind of the possibility of their being ever able to make the Work effectual, either by any Method they proceeded in, or in the Place where their Designs were advanced, and Ships and Machines had been once sunk; this made me therefore reflect in my Mind, that I had been a little too hasty in so freely laying my self open in the Point relating to the Deficiency of the Sluice they were about to place, and what was proper to be done for the Discharge of the Back-water, whereby they might, as I thought, easily have taken the Hint, and have gone a great way in becoming Masters of it: for since I believed that they must one day be obliged to begin the Work again wholly in a new Method, and in a new Place, I thought it not at all reasonable for me (who had made this the peculiar Business and Study of the best part of my Life) to explain myself any further without a valuable Consideration for it.

The Method which I found they had from the beginning designed, and gone on in the Labour of several Years, to stop the Breach, was (at Letter C, in the Draught, or Plan, prefixed) first by the carrying out of Piles, or drift Work, from the Sides, until the Passage of the Water, running in and out of the Breach, became contracted and straitned; and then, for the filling up of the remaining Space that was left, they contrived the sinking of Ships and other Machines, and with

a great Number of Hands, for that purpose, threw in great Maunds, or Baskets, filled with Chalk, and large Bags filled with Earth and Ballast, &c. which Baskets, with great Quantities of loose Chalk, Bundles of Hay, and other Matter, were to fill up the Interstices between the Ships and Machines which they had sunk; whereby they propos'd to themselves to close the Breach at once, and to give the Water such a considerable Stop, to a good height above the Low-Water Mark, in the time of the neap Tides, that they might be able to get above, and overcome the Force of the Water, before the Springs came on.

The Land-Owners had that Interest, that all the Neighbouring Country came in to assist them on these Occasions, and it was common for Men to stand in great Numbers Day and Night, upon every Reflex of the Tide, up to the middle in Water, not without the Loss of many of their Lives in the Run of the Stream in these Attempts; for there being no Sluice at all fixed, that was of any Service or Use for the discharge of the Back-water for laying the Work dry, there was, at the time of the lowest Ebb, never less than two or three foot depth of Water constantly setting with a Fall over the Works from out of the Breach, whenever any Degree of a Stop above the Low-water was made.

They several times, by these Methods, and by indefatigable Application, thus brought their Works near to a Stop (they, or Persons employ'd under them) and still found themselves unhap-

py in the Success, for when the Passage was contracted, and the Water came to be penn'd up to any difference of Level, it penetrated with such Violence either underneath the Bottom of the Ships and Machines that were sunk, or on the Sides of the Breach, that it soon bored its own way, and drove all before it again, with such force, that it is not easy to be conceiv'd nor describ'd: I have been told by one of the Gentlemen, who was concern'd in the Work, that when they had, with two other Ships, sunk the the *Lin* Man of War, the next Ebb there was not a piece of her to be seen, and three Days after there was upwards of fifty Foot depth at low Water, where she was sunk. Another Gentleman concern'd (since, my late stopping the Breach) speaking of what had pass'd with them in their Attempts, merrily told me, that at one of those times when they had made a Shut, (or attempted to do it) by the sinking among other things, a large Chest or Machine, upwards of Eighty Foot long, the next Day afterwards, the violence of the back Water setting out of the levels upon the Tide of Ebb, worked so strong underneath the bottom of this Machine, that she bolted up at once above Water, and discharging as she rose most part of the Chalk and Stones, with which she had been sunk, drove directly with the Current out of the Mouth of the Breach, whereat a Gentleman standing by, who was a considerable Land-Owner, and had been at great Expence in the Work, being much

surpriz'd, ran along upon the Wall (or Bank) on the side of the Breach, and with great earnestness called out, stop him, stop him, Oh stop him! But it seems this Gentleman was no Seaman, for if he had, he would have consider'd that such a Machine being sunk, takes so great hold in the Water when once it is a drift, that it is a very hard thing to stop, or Ride the same, in a common Streams way, much less was it practicable in the Current of the Breach; this Machine driving directly down the River, and sometimes striking against the bottom, and sometimes rebounding above the Water again, when it came down in View of the Ships at GRAVESEND, they were Alarm'd at the unusualness of the sight, (as it Emerg'd out of the Water sometimes with, and sometimes athwart the Tide) and as they Rid pretty numerous there at that time, they were forc'd to steer some one way, and some another, to avoid receiving any mischief from it. It drove from thence as far as the *Buoy* of the *Nore*, and there run aground upon a Sand.

THE penetrating of the Water either sometimes with greater force underneath the Ships, and Machines which were sunk, and sometimes on the Sides of the Breach tearing the same wider like a new Canal, made them greatly complain of Moorlog, and Quick-sand, saying, that they could easily stop the Water, but they could not stop the Ground which constantly run away from them, whereas the only true way to stop the Water was, first to have secur'd the ground: For by the sinking of Ships and Vessels, let the Ground
be

'be ever so good, the Water will bore under-
 neath in some place or other, and it was a thing
 utterly impracticable for them to make the Dam
 tight wherever Ships or other Machines were
 once sunk ; and therefore when the Gentleman,
 who brought me down, with such other Persons
 concern'd whom I found at the Breach, press'd
 me to give them my Opinion and Advice what
 they should do, I told them, that it was not in
 my power to give them any possible Assistance
 to be depended upon for effecting the Work, in
 the Place and Method which they had so far gone
 on with already ; and that since they had spent
 so great Sums of Money, and brought their
 Works so near for the making of the Shut, as
 they then hoped for, I believ'd they would not
 willingly be perswaded to quit it, and to resolve
 upon raising a new and considerable Sum to be-
 gin the Work again quite in another Method,
 and in another Place, without trying the utmost,
 in the Method they were upon. I added further,
 (as they press'd me to it) that it was possible
 they might make a Stop in the way they fol-
 low'd, and raise up a Dam by the mere Strength
 of Labour and Application ; but that I did not
 conceive how it was probable such kind of Work
 could be of any long Duration, not only for the
 Reasons above set forth, but also, that the main
 Body, or chief Matter, of which the Dam was
 compos'd, being only Chalk, the Water would
 every where search and find its way thro it, and
 must, upon the Pressure of any high Tide, en-
 danger

danger the same being thereby alone destroy'd, tho there were no Ships at all sunk, or Timber-Work in the Foundation of the Dam to lead the Penetration of the Water.

They had before my coming to *England*, sunk some Ships with other Machines, and they had then again prepared Matters ready for the sinking of two more, which they proceeded to do about fourteen Days after I went first down; but miscarried in the Attempt of their making their stop to the low Water, as they had done at other times.

Soon after this, I was, upon the Recommendation of Sir *Alexander Cairnes*, sent for over to the City of *Dublin*, upon a Proposition of mine for the making of a better Depth of Water going over the Barr. Which although it does not immediately relate to what I intended chiefly to give an Account of in this Treatise; yet being some Account how I spent my Time, whilst the Gentlemen were pursuing their fore-mention'd Attempts at *Daggenham*; and the Business I propos'd the doing of at *Dublin*, being perhaps what may not be unacceptable to the Curious, and a thing tending to the publick Good, not with regard to the Welfare of that City only, but in some degree to the mutual Benefit of both Kingdoms: I will therefore here lay down an Abstract of the respective Inconveniencies which distress that Port, and the Propositions which I made after my Arrival, for the proper Remedy of each.

The

The first considerable Inconveniency to the Port is, that at the Entrance or coming in over the Barr, there is ordinarily not above Seven Foot Depth at the Time of low Water; and the Tide not usually flowing there above Eight or Nine Foot, it makes at the top of High Water but about Fifteen or Sixteen Foot at Spring Tides, and at Neap Tides not so much; so that no Ship of any Burthen, especially if there be any Rowl of the Sea beating over the Barr, can venture to run in without a very good Calculation of the Time of High Water, but when they come near upon the Coast, let the Violence of the Weather, and Necessity be ever so great, must wait till the Tides are risen; and if they happen to miss in their Calculation of the Depth, the Ships and Mens Lives are in Danger, and have been known to suffer thereby.

Secondly, As for such Cruising Ships which sometimes put into this Port, or other Ships of any Burthen, they have no other Place of Safety where there is Depth of Water to Anchor in after they are over the Barr; but in *Pool-begg*, which is an open Roadstead, at time of high Water, or from the half Flood to the half Ebb, with but very little space for any considerable number of Ships to ride in, clear of each other in time of bad Weather: And when it blows hard from the Sea, the Waves beat in upon them over the Sand call'd the *South-Bull*, and if their Anchor starts, they have not above half a Cable's length drift before they come upon the Shore or Sand

call'd the *North-Bull*; so that it is constantly practis'd in this Roadstead (more than ever I have observed before) for Ships, Men of War as well as Merchant-men, whether fair Weather or foul, especially in the Winter-Season, as soon as ever they are over the Bar, to veer their Sheet-Anchor to the Ground, and to ride with their Yards and Top-masts down; and notwithstanding such Precaution, are not without Instances of being sometimes driven upon the aforefaid Sand, either by their own Anchors starting, or the next Ships to them; which is not only unsafe and incommodious to such cruising Ships of the Royal Navy, who are appointed, in time of War, to have their Station in the Narrow Seas, between *England* and *Ireland*, and are oblig'd sometimes to put into this Port, but also is disadvantageous and discouraging to Merchant-Ships of any Burthen; particularly such from *Great Britain*, who touch at this Port for taking in Goods, in their way to the *Mediterranean*, and other Voyages.

Thirdly, None but small Vessels of about Eight or Nine Foot draught of Water, can at ordinary Tides go up to the City, taking the top of high Water for it; and the Tide, every Ebb, constantly falls away from them, where they lie at the Keas of the City, leaving them for the most part dry on the Ground at low Water. And for such other Vessels or Ships, which cannot (especially at neap Tides) go and come from the Town with their Lading, and are oblig'd to ride
below

below *Rings-End*, as far as *Salmon Pool*, the Water likewise Ebbs for the most part away from them, and at such time that any Swell sets in from the Sea, which they lie openly expos'd to every Tide, at their first beginning to float, and again upon the Ebb, when the Water falls and they first begin to touch the Ground, they strike and thump with their Keels, untill the Tide is more Ebb'd away from them, sometimes beating their Bottoms out in the very Places where they are oblig'd to lie to lade and unlade their Goods; so that by reason of these Inconveniencies, it is remarkable that for the particular Trade, of this City, (as to the Carriage of Coals, &c.) they are oblig'd to build small Ships and Vessels of Strength like Lighters, on purpose for lying on the Ground with their Burthens.

How very disadvantageous these Inconveniencies must be to the Trade of that Port is easie to be consider'd by Persons who understand any thing of Sea Affairs, and need not be further renumerated by me.

THE Remedies which I propos'd to the City, for each respectively, were as follows;

FIRST, That I was ready to demonstrate and explain an effectual Method for the making four Foot better depth of Water coming over the Barr, to be perform'd in such manner (not hitherto practis'd,) that when once fix'd, the same should remain and continue at least to the same depth with very small Trouble and Expence to a long duration of Time, and to be practicable

by the setting of proper Marks for Ships to run in and out of the Port, with any leading Gale of Wind, as well by Night as by Day.

SECONDLY, For the better Safety and Commodiousness of such Ships which are oblig'd to Ride in *Pool-begg*, or other mention'd places below *Rings-end*, to run a low snug Wharf, or peer of Drift-work the whole way from the outermost point of the *South-bull*, to the main Land at the place called *Irisb-Town*, which I was willing to make a Pattern for the Method of doing it, and to leave the City, if they thought fit to carry on the same at their leisure, being a thing easy to be done by any other Person, but requiring more time than I was willing to spare upon it; which work I am inform'd they have since taken in hand of themselves to do.

THIRDLY, I propos'd the placing down a Sluice of Stone to some Feet depth below the low Water Mark, and to run a strong dam across, from the point of *Rings-End*, to the Highland called *Molands Buildings*, by which to pen up the Water in a Bason large enough to entertain two Hundred Sail of Ships, to run directly in and out at the time of high Water, to lie always afloat, to lade and unlade their Goods, with Expedition and Safety, at the Keas of the City, to be practis'd by the keeping up the Water always in the Bason, as high or rather something higher than the height of the spring Tides, and by the fixing of the Apron of the Sluice to the depth as before observ'd.

WHICH

WHICH two separate Works of fixing a better depth in the Barr, and making a Bason, I propos'd in my Report, upon making my Survey, to undertake the Performance of in three or Four Years at farthest, the Sum to be expended on the Work, I estimatèd not to exceed twenty thousand Pounds; And the Consideration of a Reward to my self, to be settled and agreed to after having demonstratèd what I should propose, and the same should be approv'd of by the City, to be taken in hand: having made it my Conditions upon my going over from *London*, that before I proceeded to explain particularly how and after what manner, I design'd the Practicè in the respective Methods of carrying on the said Works, that there should be such Persons whom the City should think fit, chosen and Commission'd to hear and examine the same, and that a satisfactory Caution should be first given me, that when I had produc'd the particular draught and Description of what I should proposè to be undertaken, no other Person should afterwards be employ'd in the Performance of it without my Consent, or the paying me a certain Sum of Money.

THESE things were what I laid down to be perform'd, and the Conditions on which I propos'd to proceed. But soon after my Arrival before I had gone thro' with the necessary Observations to enable me to make my Report of what I found practicable, the time came on for the Election of Mayor and Sheriffs, and some disputes

putes and Differences arising, which were near twelve Months afterwards before they were ended, and no Mayor for that time settled, nor Business of Consideration Transacted; I was thereupon inform'd by the Committee of Aldermen and Common Council of the City, who were appointed to treat with me at my first coming over, that their Power extended no further than to assist me with what I demanded for the making of my Survey, and to receive my Report, which they intended to recommend heartily to the City for their coming into the Measures I propos'd for my Encouragement.

But that the Office of Mayor being vacant, they could not Transact any thing with me until a general Court could be legally Assembled, that they were very willing to answer the demand of my Charges to be born me, and consideration for my Time, and did hope from the Representations and Petitions which were sent over to *England*, that the Affairs of the City would soon be settled, and such a Court Conven'd; therefore perswaded me from time to time to a Continuance there, which I comply'd with for upwards of eight Months.

IN about three Months after my coming to that place I had advice from *London*, that the Breach at *Daggenham* was stop'd by those Gentlemen whom I left upon it, one principal means of their accomplishing of which was, by the drift of a Row of large Piles, drove near to each other, both within and without the Ships which were sunk,

sunk, and then throwing in large Maands, or Baskets, filled with Chalk as before mention'd. But it proved, that by means of the Cavities in the Chalk, &c. there was such a constant Course of Water which run underneath and almost every where through the Works, that the Water within the Levels on the inside of the Dam, after the Breach was stop'd, Ebb'd and Flow'd every Tide, the height of three or four Foot right up and down, and thereby so gull'd and caused the Dam Incessantly to settle downwards, that it put the Persons concern'd upon making Application, and they had a Power granted them, to Impress any Chalk Vessels, &c. that pass'd on the River, which might be useful to assist them in that Work; on which occasion, it is reported, that the making of Lime, and the Buildings about *London*, was for a while in some measure Retarded. By Power of this Commission they were enabled to throw in Ten or Fifteen Freights of Chalk a Day at the Breach, to the Succour of the Works but notwithstanding it was observ'd in several places, that where they threw in very large quantities of Chalk one Day, they found the depth again as deep as it was before the next; until not long after, its being thus continued to be maintain'd, the publick News Papers became full with the Account, that the Works were wholly destroyed upon the rise of a great Tide which happen'd, and the Breach torn down to a prodigious depth.

AFTER

AFTER these misfortunes in which had been expended more than the value of the Levels, by the Reiterated Labour of about Seven Years, and the Land-Owners saw no view or hopes by all the Endeavours which they had used, of the Works ever being brought to any good Effect, whereby they became wholly discourag'd in the uniting to raise any further Sum, and deemed their Lands to be lost; The apprehensions of the growing Mischief to the Navagation of the River, began then to take place in the Minds of Men, and in the Month of *April* 1714. a Bill by the Honourable House of Commons, was order'd to be brought in, for undertaking the stopping of the Breach at the Expence of the Publick.

HEREUPON, believing it might be proper for me to make some Proposal of my Endeavours in the Undertaking of this Service, I resolv'd not to wait any longer in *Dublin*, but desir'd that my Propositions which I had made to that City, might be taken into consideration at some other time, and came over for *England*. My Intention was upon my coming over, to have laid some Proposal directly before the Parliament, relating thereto; but upon my arrival being inform'd there was a Bill already prepar'd by the Committee appointed, and that a certain Number of Trustees, would be therein nominated to see such Act that should be made, put in due Execution. I did not make any Proposal till the Act took Place.

ACCORDINGLY, in the Month of *August* 1714. the Trustees met at *Guild-hall*, of which the Right Honourable the Lord Mayor of the *City of London*, the Recorder and Aldermen for time being, were first nam'd in this Act, together with a great many other Persons of Distinction and Honour. At this their meeting they made Publication in the *Gazette*, of a Day appointed for the hearing of all such Proposals that should be made to them, for the undertaking the stopping the Breach.

THE first Proposals which were, conforming to such Advertisement, by any Person made or brought to the Trustees, was alone for the bare stopping of the Breach. Amongst several other Persons Mr. *Boswell* (whom the Trustees afterwards concluded a Contract with,) made his first Proposal for stopping of the main Breach only, for the Sum of nineteen Thousand Pounds. But the Trustees at this their Meeting came to a Resolution, that two Additional Articles should be Advertis'd in the *Gazette*, to be perform'd besides the stopping up of the Breach. Namely, the removing the Shelf that had been thrown out in the *Thames*, and lodg'd near the Mouth of the Breach. And next the making good the Walls of the Levels, extending from the Point of Land above the half way Tree, down to the Mouth of *Raynham* Creek.

I attended at this Second meeting of the Trustees, and made my Proposal to them for performing

forming of the said respective Articles, for the Sum of Twenty four Thousand Pounds.

BUT Mr. *Boswell*, who had before made his Demand for the Sum of Nineteen Thousand Pounds, notwithstanding the said two Additional Articles, appointed by the Trustees, brought in his Second Proposal, for the accomplishing of the whole Work for the Sum of Sixteen Thousand five Hundred Pounds, and to be compleated wholly at his own Risque, and to begin with his own Money.

THE Trustees hereupon thinking him to be the fairest Proposer, that would engage himself for the least Sum, and rather more at his own Risque, than any other Person propos'd to do; They very readily came into the Resolution to Contract with him; without taking upon them to examine, whether his Skill was equal to his Proposal, or was able to go through with the Work or not, as apprehending themselves not to be proper Judges in so difficult and Precarious a Work; which occasion'd my aforesaid Proposal which was for so much a larger Sum than Mr. *Boswell* had offer'd, to be therefore entirely rejected, and he went on with his Undertaking; having made it sure that no Man else would go below him.

As it now comes in the proper Place, I shall go on as near as I can to give the Reader a very short, but just Account, of the Scheme and Method he design'd and laid down for the Perform-
ance

ance of his Work, and wherein he had the Unhappiness afterwards to miscarry, and to render the Breach much more Chargeable and Impracticable to be stop'd than when he began it.

THE Method which he intended first to make use of, in the Stopping of the Breach, was by six large Ponts or Chests, of sixty Foot length, thirty Foot Breadth, and twenty Depth, flat at the bottom, and pointing away sharp at each end, like the Sterlings of *London Bridge*. These Machines he propos'd to sink at about twelve Foot space from each other, beginning from a Peer, to be carry'd out on each side of the Breach, conformable to the Shape of the sides of the Ponts, which Peers were first to be built, and the bottom of the Breach to be made Level for the sinking of the said Machines, and when they were sunk at the distance aforesaid regular by the side of each other, then the Spaces between them were design'd to be fill'd up by Piles and Drift-Work. In the upper part of these Machines, there was intended draw-sluices to be made, which were to stand open, until the respective Spaces between the said Chests were to be likewise filled up, and then the Sluices made in the Machines were all to be shut down, and so at once to stop the Water out of the Breach. This is the short of what I have been inform'd he first laid down his Scheme for, and did intend to put in Practice: But after he had, by the carrying out of his said Peers a little way from each side of the Breach, thereby contracted the Passage of the Water going in and out,

out, it began soon to move with the greater Force, and work'd away the Ground in the bottom of the Breach, in such manner, that he found it would never be practicable to make, or maintain the Foundation level, for the sinking his Machines, or the keeping them upright in their Places, to any regular Order or Form.

THEREFORE he quite laid aside his Intention of having the aforesaid Number of Chests built; (for which he had fram'd the Bottoms in a Yard by *Vauxhall* Bridge) and resolv'd to have but two Chests made, and afterwards laid aside his Thoughts of two, and resolv'd but upon one only, which was finish'd in a Dock at *Blackwall*, and instead of a greater Number of such Chests, to carry on his Work to a narrower space, with Piles, &c. But as he went on with the driving of such Piles, and fitting and squaring of Matters to them, as he drove them, he found the Ground to be still more violently torn and driven away from him, to a very great depth; he therefore then entirely chang'd his Scheme, with relation to his Chests, and came to a determin'd Resolution to make use of the Method of the sinking of Ships, as had been before done by the Land Owners; for which Purpose, he Projected at first, the Sinking of one Ship only, and conforming to which Design, he drove out Piles from each side of the Breach, until he came to meet in the middle, within about 30 Foot, which was the breadth of the *Abingdon*, a Ship which he had got ready to sink, intending to close and fill up.

up his Works to some little height above the low Water Mark; by throwing in Chalk and Hay, &c. when such Ship should be sunk; also he provided a great Number of large strong Hair-baggs, some of which were near thirty Foot in length, which he Rafted and bound by Cords together, to sink underneath the bottom of the Ship, for her to sit upon and bed her self into, as well as others of less Dimentions, in Order to fill up the Interstices or Spaces, between the Ship and the Peers or Jetties, and for the keeping and securing the Chalk, from being wash'd or carried out of the Jetties; by the force of the Water; he sunk large Sheets of Boards, down by the Sides of the Piles to the bottom of the Breach: But whilst he was thus bringing out his said Jetties, and preparing his intended Matters in one neap, for the sinking of his Ship in the next, the Operation of the Spring Tides (which Alternately happen every Fortnight, or little more) gull'd and tore the Chalk out of his Jetties, broke down and carried away the Piles, to a greater width, and made the Foundation into which they were drove considerably deeper than it was before, which after he had thus made tryal two or three Times, and found the Mischief which was done gain'd upon him, so that the damage which happen'd in the time of the Spring Tides, still grew to be more than he could make good again in the neaps, he then resolv'd to square and compleat his Jetties, or Peers, for the making the said Space in the middle of his Works, to the breadth

of Sixty Foot only, and to sink two Ships instead of one. Accordingly when he had prepar'd Matters in readin^{cs} as before described, and purchas'd a Second Ship, he proceeded on and sunk them both together, in the said Space at the Time, of the neap Tides. As also for the more effectual making of his intended stop to the low Water Mark, he sunk at the same time, a small Vessel between, and at each Quarter of each Ship, both on the outside of his Works towards the *Thames*, and on the inside towards the Levels; amongst which was the foremention'd Pontoon built at *Blackwall*; which Machine and smaller Vessels, were thus sunk at the end of the Ships, the better to back and support the Chalk, Hay, Baggs of Earth, &c. which was prepar'd both in a Magazine on each side of the Breach, and put into a great Number of Vessels which lay ready above and below the Works for that purpose, and was accordingly thrown in with the greatest Application that was possible, at the same time when the Ships were sunk, or some of it the Tide or two after. Thus he, with his utmost Endeavours, proceeded in hopes to have made such a stop to the low Water in the time of the neap, that he might have been able to have rais'd and secur'd his Works to a much greater height before the Springs came to take Power.

BUT the Water finding its passage the very first Tide after the Ships were sunk, began to Operate with such Force underneath the bottoms of them, and the other Vessels, as well as amongst the
the

Piles, and Drift-work on each side of them; that the Chalk and other Matters which had been fill'd and thrown in, was torn and driven away, and the ground with it to such a depth, that both of the said Ships with part of one of the Jetties, settled right down near two Fathoms, and the Second Day after the Attempt was made, one of the Vessels which had been sunk on the outside of the Ships, next the *Thames*, (laden with Chalk, and Rubbish,) was thrown up and cast upon the Bank on the inside of the Ships to above Sixty Yards distance from the Works, and the sote-said Machine built at *Blackwall*, rose up from the Ground, broke and tore to pieces; the Water, when once but a little pent, being of that forcible Power, that wherever it gets the least Passage, especially where the Ground is bad, it soon makes its own way until it comes to move more upon a Level and with more ease; of which I shall have occasion to speak more hereafter.

THERE is another thing proper to be taken notice of in this place, relating to Mr. *Boswell's* Flood-gates or Sluices, (as they have been term'd) fix'd in Cutts, which he made in the Walls of Banks of the Levels to the Eastward of *Daggenham* Jettie, made only with Gates design'd to open outwards, but not with proper draw Doors to pen the Water either in or out of the Levels to any height required, as I have since made my Sluices, and was absolutely necessary (in my opinion) to facilitate any Method whatsoever for stopping the Breach. He had two of these Sluices

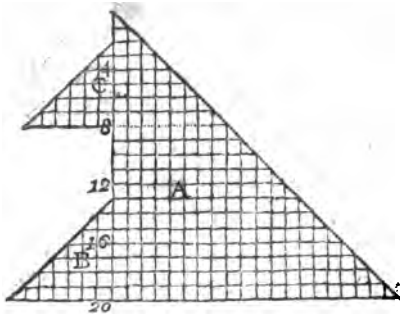
which he had placed upon the Land, with their Aprons about thirteen Foot perpendicular height above the low Water Mark, without any Canals cut to them through the Marsh Land, by which Scituation they could not possibly be of any Service to him, in the laying his Works dry; at the height which he carried on his intended stop at low Water; had there been a hundred of them; the said height which he carried on in his Works, being near Eight Foot below the Marsh Ground, nor could they afterwards, had he succeeded in his said Attempt, have been of any use in giving ease to the Water running over his Works, any longer than the first Quarter, or first third Ebb; when the Water either run out with but a very thin Body, or not at all over the Aprons of his Sluices, and the Current set with the greatest force out of the Breach. Again, upon the first part of the Flood, when the Tide usually rises the quickest, his Sluices could be of no use, in saving the fall and force of the Current setting in over his Works, (as he carried them on) until the Water came to rise above the height of the Marsh Land, and to set in with some depth upon the Aprons of his Sluices. And they were not at all made practicable to be shut near the time of high Water, to keep out the long slack at the last part of the Flood, and first pinch of the Ebb, which was very proper to have been done.

AND besides they were not only thus injudiciously fix'd, with respect to their Scituation; but so very slight and defectively built, that when he
grew

grow near the making his said Attempt, for stop-
 ping at low Water, and order'd his Gates then to
 be shut; to keep the Flood Tide from having its
 passage that way; that there might be less Power
 of the Backwater setting out over his Works on
 the Tide of Ebb; tho' the Breach still remain'd
 open, and the Water flow'd on the Inside, as well
 as on the Outside of the Levels, and could not, at
 the Height of the Tide, (at which Time the Wa-
 ter had its greatest Weight) be above twenty Inches,
 or at most two Foot difference of Level. Yet the
 Water found its Passage underneath his sluices,
 and after he gave over his Undertaking, tho' his
 Gates were then set open, and some of them un-
 hing'd and gone, before I enter'd upon the Spot,
 the common flux and reflux of the Tide, gull'd
 and tore away the Earth to several Foot breadth
 on the backside, or behind the Wharfs of his
 Sluices; and the Apron of one of them was
 blown up and thrown into the Levels, within a
 few Months after I began my Undertaking, with-
 out any other Pressure of Water than before
 Thrown; so that had his sluices been fix'd to the
 depth that was necessary, and with draw Doors,
 in a proper manner made to them, in my Op-
 nion, they could not have endur'd the twentieth
 part of the Weight that was to come against them,
 if he had stop'd the Breach; and this Maxim is
 always to observ'd in Cases of Workmanship,
 (relating to the Power of Water,) that whatso-
 ever comes short of its due Strength is infinitely
 so.

By reason of the Deficiency of his said Sluices, and that the Passages, or Cutts, which he made for them in the Walls, whilst they stood open, admitted more Water into the Levels upon the Tide of Flood, than was discharg'd by the same Passage upon the Tide of Ebb; it being observable, that the first part of the Ebb falls away quicker than the last part of the Tide rises, (the common stand at high Water included) I therefore was under a Necessity to be at the Expence of stopping them up, before I proceeded to raise my Dam in the Breach, or whilst I had made the grand stop to the Water flowing into the Levels in one place; I must inevitably have had two other small Breaches encroaching upon me, by way of his Cutts,

And that what I have here said may be the better understood by Persons to whom this Matter may be somewhat foreign, relating particularly to the Deficiency in the Strength or Workmanship of his said Sluices, I will here lay down the Quantity and Nature of the Weight, or pressure of Water lying against any Sluice, Dock-Gates, Dam, or Penn of Water whatsoever. As for Example, Let the Perpendicular Line, represented



presented by the Triangle A, be suppos'd to represent the height of twenty Foot Water, lying against any Gates: And one cubical Foot of brackish Water,

(such as is here at the Breach) I have experimented, does weigh sixty four Pounds, or very near it, and the Weight of Water for each single Foot in breadth, lying against every Foot in height of any Gates or Sluices, wherever any Penn is made, always pressing, as is described by the Hypotheneuse of the said Triangle A, *viz.* where there is only a Penn of six Inches depth of Water, there lies but the Weight of eight Pounds pressing against one Foot in breadth; and against one single Foot height of Water being pent up, there will lie but half the Weight of a cubical Foot, or 32 Pounds; and against the second Foot height of Water, the Pressure encreasing, as represented by the Hypotheneuse of the said Angle, the Weight will be 128 Pounds; and against twenty Foot height, 12800 single Pounds; or divided by 112 (Weight Averdupoize) it gives five Tuns, 14 *Ct.* 1 *qr.* 4 *l.* lying against every twenty Foot in height, to one single Foot in breadth, and so for the whole width of any Sluice or Penn of Water, in whatsoever manner

it be made: As for instance, I have, on Spring-Tides, often had upwards of 20 Foot Water lying against my Sluices from the *Thames* side, since the time of the Breach being first stopped, and one of them being 36 Foot in breadth, the same computed at only 20 Foot height, makes 205 Tons, 14 Ct. 1 qr. 4 l. Pressure of Water lying against one of my Sluices; but again there being about 7 Foot depth of Water upon the Apron of the Sluice, remaining pent up in the Levels, the same is (or was before the time of my Dam's being made in my Canals) a Counter-Pressure of 7 Foot in depth, described by the Angle B, which computed by multiplying the said 7 Foot by half the said depth, and again by 64, (the Weight of a cubical Foot of Water) and then by 36, the breadth of the Sluice, and dividing the same by 112, makes 25 Tun, 4 Ct. which being subtracted from the Weight which presses on the *Thames* side, makes 180 Tuns, 10 Ct. 1 qr. 4 l. lying against the whole breadth of the Sluice; or being computed for one single Foot in breadth, the Difference of the Pressure will then be 11232 Pounds, or 5 Tuns, 32 Pounds.

Again, the Aprons of the Sluices which were made by Mr. *Boswell*, (or Persons directed by him) being not fixed above eight Foot depth below the Rise of the usual Spring-Tides, and the Breach being, as before observ'd, not at all stop'd in his time, the Water had an uninterrupted Passage into the Levels, and thereby, in some degree undeniable, constantly flow'd and swell'd

on

on the Inside (of the Walls or Banks) as well as on the Outside of his Sluices, and the Difference of the Level at high Water, according to my own Observations, and the best Account I could have of it, did, at Spring-Tides, not exceed the height of two Foot, *viz.* eight Foot on the Outside of his Gates, as laid down by the prick'd Line drawn in the Triangle A, and six Foot on the Inside, laid down by the Triangle C; so that by the Rule aforesaid, the Pressure of Water (at 8 Foot depth) lying on the *Thames* side against his Sluices to a single Foot in breadth, amounts to 2048 *l.* or 18 *Ct.* 1 *qr.* 4 *l.* Averdupoize Weight, and subtracting therefrom the Counter-Weight on the Inside, described by the Triangle C, reckon'd at six Foot depth, according to the Difference of Level before taken notice of, and at a single Foot breadth (containing 1152 *l.*) there will remain only 896 *l.* or 8 *Ct.* Averdupoize; and yet this small Pressure of Water before described, made its Passage both underneath and on the sides of his Sluices, as has been evident to every one that has seen them, when the Water has been either going off, or coming on upon the Aprons.

I have been the more particular in this Explanation, because some hard Censures have been imputed to me, as if my engaging in the Work out of his Hands (as it has been call'd) had been injurious to him, or that he only wanted Time and Money to have enabled him to accomplish his Undertaking; whereas, by the Methods he
 . pro-

proceeded in, I believe, had he had all the Time and Money in the World, no part of his Work could ever have been effectual; as by the Principles laid down in the Description of my Method, the Reasons for my Opinion will, in the following Pages, more plainly appear.

Soon after his foremention'd Miscarriage, in stopping to Low-water Mark, he gave over working any more at the Breach, and the time, for which he had enter'd into his Contract, being claps'd, the Trustees met, and appointed a Committee to go down and view the State of his Works; a Copy of the Report which they gave thereof, is as follows.

To the Honourable the Trustees, appointed by Act of Parliament for the stopping of Daggendam-Breach, &c.

IN obedience to an Order of the said Trustees of the 4th instant, We whose Names are subscribed, have met, and taken a View of the State and Condition of the Works now standing at the said Breach, set up by Mr. *William Boswell* the Undertaker, and continued there upon the said Works from half Ebb till Flood; and upon Low-water we went in a Boat, and found the several Depths of Water to be as follows,
viz.

ON

On the West side 20 Foot below the Works to the South, 40 Foot deep. On the South side of the Work 20 Foot from the Stern of the *Abingdon* (one of the Ships sunk in the said Breach) 30 Foot deep. On the same South side of the Works 15 Foot from the Stern of the *Recovery*, (another Ship sunk in the said Breach) 18 Foot deep. On the South side of the Piles, standing on the East side of the said Breach 10 Foot from the said Piles, 18 Foot deep.

BETWEEN the said Ships and the Piles set on the West side of the said Breach 29 Foot deep. Betwixt the Works to the Northward near the Piles on the East side 24 Foot deep. At the End of the said Piles on the East side 19 Foot deep. Fifty Foot distance North from the said Piles 31 Foot deep. Fifty Foot further North 50 Foot deep.

FROM the Piles on the West side 25 Foot, North 26 Foot deep. Fifteen Foot North from the said Piles on the West side 14 Foot deep. Close to the said Piles on the West side 20 Foot deep.

COMING about the Piles to the Southward, we find these Depths following, *viz.* 29, 24, and 18 Foot deep.

WE find that all the Works made by the said Mr. *Boswell* upon the said Ships (before they were by him sunk as aforesaid) are either broken or cut away; And the Westernmost of the said two Ships is entirely under Water, except some few of her top Timbers at the Stern, about a Foot above

above Water, and the other Ship sunk on the Eastermost side, lies with her Head in deep Water out of sight, and her Stern twisted in sinking and very much shatter'd; one part of her Larboard Quarter lying about eight Foot above Water, which with the Condition of the Piles on both sides the said two Ships, some being broken and carried away, and others being loose and may go away the next Spring Tides, and the depth of Water between the Ships and the Piles on both sides, to which add the Consideration of the depth of Water on the Watermost side below the Works, and the shatter'd Condition that the Works do there appear to be in, as well as on the Eastermost part of the Works on both sides, where upon the sinking the said Ships, the Piles, together with the Hurdles and Chalk, blew up and washed away: We humbly conceive, that it will be impossible for the said Mr. *Boswell* to make any secure and regular Foundation upon the said Ships, as they now lie: And we believe that the said Ships will not remove away, but that the most part of the Front Piles next the said Ships, may be carried away by the next Spring Tides, which we are well satisfied must be the Consequence from the great depth of Water between the said Ships and the Piles, as well as on the North and South side of the said Piles, both on the East and West side of the said Ships.

WE are further of Opinion, That if the said Mr. *Boswell* had succeeded in the sinking his Ships, as he could have wish'd, yet that his

Works

Works in general were not strong enough to withstand so great a weight of Water. All which we humbly submit to the better Judgment of the said Trustees. Dated this 7th Day of *November*, 1715.

John Ward,
Tho. Pannwell,
John Mayhew,
Tho. Tatam,
William Johnson,

William Cotesworth,
John Austen,
John Hazelwood,
John Merry.

The Trustees, after they had received this Report, and given Mr. *Boswell* one or more Hearings, with relation to what he could further offer, without his giving them (as is presum'd) any Satisfaction: They appointed a Day, to be advertised in the *Gazette*, for their Meeting, to receive new Proposals from whomsoever should offer the undertaking for the stopping of the Breach; and about fourteen Days time, as I remember, was given for this purpose.

Upon which Mr. *Boswell*, Mr. *Ludgate*, and at least four or five more, attended with their Models and Propositions; some offering to suffer Death if they did not do it, some to be employ'd under the Commissioners, and two of the Proposers offered to give Security, one of which was for doing the Work for 35000 Pounds; and amongst those, who proposed Security, I offered to undertake the Work for 27000 Pounds; but that if the Trustees would be pleased to appoint
 my

my Scheme, or Method, to be examined; and would give me a Caution of 5000 Pounds, that after I should explain and lay down a proper Method to them, no other Person should be employ'd to make use of the same, in the stopping of the Breach without my Consent; and that, in case of their Approbation, after such Discovery to be made, they would then please to take my single Bond for the Work to be done at the publick Risque, without my procuring Friends to be engaged in it, I was ready to undertake it for a much less Sum. But the Trustees, upon their receiving of this and the other Proposals which came before them, were so very far from coming into what was offered by me, that they made a new Order, that whosoever would undertake the Performance of the Work, should not only find Security for the Repayment of all such Money which should be received from the Trustees, in case of the not performing the Work; but also be obliged to the further Payment of 10000 Pounds, to answer such Damage to the Breach, which any further unsuccessful Attempts might occasion; it being certain that it was not practicable to be taken in-hand in either of such Places, where the Land-Owners, or Mr. *Boswell*, who succeeded them, had been at work. Whereupon they appointed another Day for the bringing in new Proposals conformable thereto.

This new Order put me, I must confess, under some Difficulty, to find Friends ready to engage

in such Security, so that I was about to have declin'd offering any further Proposal, and to stand still a while, to see who would be the next undertaker, but considering that the most part of those who made Pretensions to be employ'd were not able, or did not offer any Security at all to the Trustees. I therefore drew up a Proposal in which I offer'd to the Trustees, to undertake the Work for the Sum of 30000 Pounds, and to give them Security for the forfeiting of five thousand Pounds, over and above all such Money as I should receive from them, in Case of my not effecting the Work. And in this proposal again press'd the Consideration to them, that as I presum'd the effecting of the Work, with Certainty and Security to the Navigation of the River, was a thing more sought for by the Trustees, than the strictness of any Terms of Penalty enter'd into by any Undertaker, so if they would be pleas'd to appoint a Committee to Judge and examine the Schemes of the several Proposers, I perswaded my self, I should be able to give them such satisfaction of the Certainty of the Performing the Work, that would be more agreeable to them, than any Security whatsoever, and I mention'd, that as by all the Methods which had been practis'd, and Schemes which I had seen it was impossible to stop the Breach, so as to be of any long duration, and that every Miscarriage must still make the Breach worse, and as neither the Persons who had already practis'd their Endeavours, nor those who made now new Proposals, did pretend to offer

offer any Method from any Certainty of their own Experience, so if after the Examination of what I should lay before them, there should be any one Gentleman of the Committee to be appointed, that should think any other Proposition better or equal to mine, I was willing to give Place without more trouble to the Trustees; but if on the other hand, the Scheme, that I should lay before them should be unanimously prefer'd and approved, then I hoped that my Experience of it would be deem'd equal to a greater Security, than any that I had offer'd.

AFTER my delivery of this Proposal to the Trustees, they were pleas'd to let me know, that they had resolv'd upon appointing a Day to have all Proposers bring in their Schemes to be examin'd, and that they might the more effectually be enabled to judge and distinguish what Method should be the most probable of carrying with it the desired Success: They invited to their Assistance Brigadier *Richards*, Surveyor General of his Majesty's Ordinance, Mr. *Acworth* Surveyor of the Navy, and Coll. *Armstrong*, first Engineer of *Great-Britain*. These three Gentlemen were accordingly pleas'd to favour the Trustees with their Company at *Guild-Hall*, on an occasion so much look'd upon tending to the publick Welfare. And after several other Proposers had produced their respective Schemes, I was call'd in, and Presented the following Propositions to be examin'd, which being a Method not practis'd in any Country that I have heard of

before

before I had occasion to make use of it in a Foreign Service, I mean so far as relates to the Use of Dovetail Piles, which tho' the same have been us'd about the King's Docks, yet having not, as I know of, been before apply'd in the making of Dams, and having found it to be the only secure way that can be depended upon for the making of large Dams, where there is any Considerable Pressure of Water and the Ground Bad; I will therefore give it a Place in this Treatise, for the use of those who may in any future Misfortune, in the Banks of the *Thames* or otherwise, have any Benefit by it.

THE DESCRIPTION, of a Method for the effectual Repairing of the Breach, in the Levels of *Harvering* and *Daggenham*, according to my Proposal, Humbly offer'd to the Right Honourable the Trustees, in the Year 1714, and again Renew'd the 29th of *November*; and the 6th of *December*, the Present Year 1715:

FOR the better Understanding of my intended Method, I shall first lay down Two general Rules, or Principles, which to Facilitate a Work of this Kind, where there is a great Rise of Tide and Inlet of Water, is absolutely necessary to be observ'd.

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FIRST,

FIRST, THAT a sufficient discharge of the back Water, which flows in upon the low Lands and has worn a Creek, with large Branches a great way into the Country, ought to be made by fixing of a sufficient Sluice, at least down to the depth of the low Water Mark or some Feet below it, whereby to ease the Force and Fall of the Current, whilst the needful Work for the stopping of the Breach is carried on, which otherwise must be attended with a very Expensive waste of Labour, Time and Materials, and to make the Foundation tight and secure, would be utterly Impracticable.

SECONDLY, where a Dam is intended to be made, in a place where the Spring Tides every Twelve Hours, and twenty Four Minutes, usually flows 22 Foot, and is (as in the Case of the present Breach) by the unskilful Attempts that have been made, torn and worn down in several Places, to double that depth below the Surface of low Water Mark, the greater Care ought to be taken to make the Foundation tight and secure, that it may not be Possible for the Water to penetrate either underneath or on the Sides of the Creek or Place that is to be stopped up, for if once the Water finds the least Passage, especially at the Foundation where the greatest Pressure of Water will always be, and perhaps but very ordinary or bad Ground, there will then be inevitable Danger, that either in the Practice

Case of carrying on the Work, or afterwards when compleated, upon the Rise and Pressure of an extraordinary Tide, the Water (tho' the Leakage may seem but small at first) will then Augment it's Force, and undermining the Foundation of the Dam, will settle down from above, and tear away all before it.

AND for the same Reason it is also absolutely necessary, after the Foundation is secur'd, that the Body of the Dam be made and composed of such Matter, as may be safely depended upon to be tight, and therefore by no means proper to have any Ships or Chests, or any sort of Timber Work whatsoever sunk, or laid therein, to which the Earth, or Matter of which the Dam is compos'd, cannot be close, and must be a guide to Leakage: As for Instance, if but one single Piece of Timber be laid or placed through a Dam, especially near the Foundation, and where the Ground is bad, the Water will certainly penetrate on one side or other of such Timber, and carrying always some Matter with it, will soon create a hollowness in the Dam, and cause the Earth to settle down from above, which upon the Pressure of any high Tide must inevitably destroy the whole Work, and can never be trusted.

THESE Principles being laid down, I shall proceed to show, that the Dam I intend to make for the effectual stopping up of the said Breach, shall first be well secured, that there shall be no fear of any Leakage neither underneath at the

Foundation, nor on the Sides of the Breach or Creek; and Secondly, the Body of the Dam shall be entirely compos'd of good Earth, or Clayie sort of Ground, from the very Foundation to the top thereof, without having any sort of Timber Work, sunk or laid therein, only I intend a Row of dovetail'd Piles, to be drove through the middle of the Dam, to secure the Foundation, and upon the Sides a strong drift Work to be made, to be as a Buttress or Foot Wharf on each side to keep in the Earth, with which the Dam is to be filled, to prevent the Dam from spreading and settling out at Foot; and on the outside of the said Wharfs which are to be built only a little above low Water Mark, a strong Wall, or Foot of Chalk, to be laid equal with the height thereof. The dam thus finished without any sort of Timber Work but what will remain constantly wet, will, with very little or no Repairs, stand fast and endure for ever, and the Method which I design to proceed in, in the Performance, is as follows.

NEAR the Banks of the *Thames* on the Starboard or East-side, going into the Mouth of the Breach, right against the place where I design to make my Dam, I shall dig down a place in the firm Land, for the fixing of a Sluice near 40 Foot Broad, and for the Foundation to be palc'd at least down to the depth of low Watermark, as before mention'd, to be made with a set of draw Doors, on purpose to shut down and draw up as shall be occasion. And after the Sluice is thus completed,

pleated, a Canal must be cut through from within the Dam that is to be made in the Breach, to the *Thames*, to let the Tides have their free Course through the said Sluice, until such time as the Foundation of the Dam is secur'd, and fixed quite a cross the Breach, to about two or three Foot height above the Surface of low Water Mark, which I intend to do as follows.

FIRST, I design to drive down a Row of Piles as aforesaid, Dovetail'd into the Sides of each other, as deep as they will go, about 6 or 8 Foot or more, according as the Ground proves, into the Foundation, quite across the Creek where the Breach is to be stopp'd up, and extending, at least 20 or 30 Foot into the Banks on each side, the whole way to secure the bad Ground, lest the Water should any where penetrate and undermine the Foundation, by the want of which being secured in the Attempts hitherto made, the Water has still bored under the Foundation, and has been the great Cause why the Work after being more than once stopp'd up at the low Water Mark, has broke down again, and the Breach been still worn broader and deeper by it, and unless this great Evil of the bad Ground which is at the Foundation, be rightly provided against, it is too much to be fear'd that all Attempts whatsoever, will sooner or later have the same unhappy event, and I am very Positive, that there is no other way in the World whereby it is possible to secure the said bad Ground but by driving Dovetail'd Piles: And which tho' I have laid down this Method, every

Man is not capable to put the same in Practice, with that Truth and exactness required in the doing of it.

I design to begin first and drive the said Piles in the firm Land or Banks, on each side of the Creek, and continue them on by a fair Line until they meet and shut up with the last Pile in the Breach or Creek, and as I go on with driving the said Piles, and thereby stop the Course of the Stream, I design at the same time to advance and carry on the aforementioned Foot-Wharfs, on each side at about 40 Foot distance, from the said Line of Dovetail'd Piles: Which Foot-wharfs I intend to be made about 18 or 20 Feet Breadth, to be filled with Chalk, and Chalk Rubbish, and as they are carried on, a strong Bed of Chalk is to be continued on the outside also.

By Reason of a free Passage being made for the Tides, through the Shuice as aforesaid, the Stream will not begin to run with any considerable Force in the Breach until the said Row of dovetail'd Piles come near to be shut up in the middle; and then there will be occasion to find means to secure and support the Heads of the said Piles, against the Weight of Water, which will (as the Tides set in and out) begin to be pent higher upon the Ebb, on the one side, and on the Flood on the other, and for which nevertheless, an opportunity must be taken to shut the said Piles at the dead of the neap.

THE time which I design to carry on the said Works, will only be at the latter part of the
Ebb

Ebb, and the first part of the Flood, when the Tides being much below the Surface of the Land, and having Communication only with the Creek or Arms, cut and worn into the Land by the Breach, will have no great Power, till risen to a greater height, and I shall leave the Heads of the rabbitted Piles not above a Foot or two above the ordinary Surface of low Water-mark, and those belonging to the Foot-wharfs but very little higher, so that when the Tides come to rise, and spread upon the low Land, and set either in or out of the Breach with any considerable Force, there will then be depth enough for the Water to run over the tops of the said Piles, besides, having a free Passage through the Sluice, until all the Piles are drove from side to side, and the Breach quite stop'd up at low Water.

THE said dovetail'd Piles must be made about Seven Inches thick towards the Sides, and eight Inches towards the middle of the Dam, where the Water is deeper, and being jointed the whole way into the Sides of each other they will be like one solid Piece, or sheet of Timber, driven at least 6 or 8 Foot into the Ground, both quite athwart and into the Banks on the Sides of the Breach or Creek, and being made of Fir Timber, will swell and be tight, as I have experienc'd the Practice of in the *Czars* Country, where I have had from 20 to 26 Foot Pressure of Water more upon one side of my Dam, than upon the other, and have been oblig'd sometimes to fix my Works in Ground that has been very bad, and yet my Dams have not leaked nor been de-

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destroy'd

stroy'd by the Floods, which in that Country are very Powerful upon the sudden melting of the Snow in the Spring of the Year: The particular Engines, and Stages to be us'd, and the manner of driving the said Piles regular and true, as also after what Manner to support the Heads of them when they come near to be Shut up, I am ready further Verbally to explain, if required of me.

As the said row of Piles are drove through the Dam, and the course of the Stream thereby stop'd at Low Water, the filling of the Foot Wharfs with Chalk as afore mention'd must be continued, and all the way between the said Foot Wharfs, the Body of the Dam must be fill'd with the best sort of Earth or Clayie Ground that is nearest at hand. And to prevent and gradually take off the Force of the Tides setting in and out of the Breach after the Dam is once stop'd at Low Water, and carrying up to a greater height, then, every Tide the Doors of the Sluice must be constantly Shut down to Pen the Water wholly in, just when ebb'd off equal with the height the Dam is rais'd to in carying up of the Work, as also must be observ'd upon the Tide of Flood when the Water is risen to the same Height without in the *Thames*, as it is penn'd up to, within in the Breach, the Doors of the Sluice must be immediately drawn up, that the Tide may equally Swell within as well as without the Breach, and thereby Ease the fall of Water in the Running of the Tides over the top of the Dam.

THE Dam after once stop'd at Low Water may be considerably advanc'd every Tide when 'tis Weather for Men to Work, and will not require many Weeks to raise the same high enough to Shut the Tides wholly out of the Low Land, sufficient Hands being employ'd for it.

BUT since it is certain that besides the Injury to the Navigation of the River, the difficulty and Expence of making good the said Breach in a Place that has so many Times given way, and is so much destroy'd, will be abundantly greater than if it had happen'd in any other part of the Banks of the *Thames*, so much the more care ought now to be taken that the same may never be in danger of breaking out again, anywhere in or near the present Breach, therefore it will be necessary to raise both the said Dam and the Banks Adjacent, to be (after well settled) at least a Foot or a Foot and a half higher than any other Place of the Levels, so that altho' the Tides should happen by any Violence of Weather to rise higher than was ever yet known, and quite overflow all the Banks of the *Thames*, it may never endanger doing the same any hurt; for in case of such a Tide as is suppos'd, where the Water once takes power, the Violence of the Stream is always Strongest in the lowest Place, and only where it first gets over, there it presses with ungovernable Power, destroying all before it; whereas at such Places that are made higher, tho' also happening to be overflow'd, yet the Tides by first running over the
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the low Places the length of the whole Level, will have fill'd the Marshes, and the Water becoming on a Level, can move with no Fall or Force of the Current, either upon the Flood or the Ebb, to break down or do any Damage to such Places that are rais'd higher than the rest of the Banks, provided there be no Leakage at the Foundation, to cause the same to settle down by any Force of the Tides.

THUS I have propos'd my Work first to be made effectually secure at the Foundation.

SECONDLY, To be made in that Order, and compos'd of such Materials, that will not be subject to Rott and Decay,

THIRDLY, That altho' the Floods and Storms should happen to be greater than was ever yet known, the same to be so finish'd as not to be endanger'd thereby.

LASTLY, When both the said Dam is compleated and the adjoining Banks rais'd to the height that is requir'd, then the aforementioned Canal to be made for the discharge of the back Water must be also effectually stopp'd up, and the Sluices broke down and taken away; for otherwise the Sluice when once decay'd, would give way and endanger the making of a new Breach.

THUS

THUS I have fully laid down my intended Method, as to all the Main and most Material Points for the Performance of the said VVork, with my Reasons about the same. And any thing else which may not be rightly understood, I am ready further Verbally to explain (if Com-manded,) on Condition that no other Person shall afterwards be employ'd upon the same without my Consent, according to my several Proposals delivered to the Right Honourable the Trustees on the Dates abovesaid.

London Dec. 12. 1715.

THIS Description, together with the Draught, or Plan, of the Foundation of the VVork as I propos'd the same to be carried on, particularly with Relation to the Foot-wharfs and Dovetail'd Piles to be drove for shutting the same to the Low VVater Mark, I laid before the Gentlemen conven'd as aforesaid, who upon Examination thereof, agreed in their Opinion, that the driving of Dovetail'd Piles in the Manner describ'd, must certainly be the most secure Method for preventing of Leakage, and stopping the Breach, provided the same could be reduc'd to Practice, but no Instance being known in *England* of such Method experimented in the like Case, of making of Dams, tho' some Gentlemen very readily approv'd it, yet there were others who doubted, whether

whether in the Violence of the Stream which set in and out of the Breach, such Piles beginning at each End of the Dam (as laid down in my Description) could be brought by a straight Line in the depth of 20 Foot of VVater taking the Time of Low VVater for it, to meet in the middle of the Breach, and be out of winding, (*viz.* the Heads and the Points to be Parallell to each other) in the same continued Line as first drove down, so as by one single Pile at the last, to be enter'd at the Heads of those on each side, to joint close into the Grooves made for it in the driving down, and make an effectual Shut like one entire Sheet of Timber. But upon my Reasons and Verbal explanations of the Methods I intended to use for the facilitating this Difficulty, and for Securing the said Piles by the help of the Foot-wharfs, from their being born down by the Tide. Likewise upon the Affidavits I produced, of my having Practis'd the same Method in the Performance of considerable VVorks in *Russia*, it was Unanimously agreed that what I propos'd was the only probable way to Succeed and Effect the VVork, and declar'd it their Opinion, that if it could not be done by Dove-tail'd Piles, it was impossible ever to be done by any of the Schemes which came before them, or other Method whatsoever.

As I ought to be very Cautious not to mention the least Syllable but what was agreed and declar'd

declar'd to be the Opinion of those Gentlemen of Judgment and Honour who were then present; so I do not remember there was any other Debate concerning the Method laid down, excepting with Relation to the Practice of placing down a Sluice in bad Ground, which I gave them Satisfaction in; and whether driving Angular indented Piles as the Heads are describ'd at



Letter A, used by the *French* at *Dunkirk*, and in the securing of their late Works at *Mardyke*, might not be preferable, which was objected by some of the Gentlemen who were present. But upon my explaining to them, that I did not apprehend any Method whereby it was possible to guide such indented Piles down by the Sides of each other, and to keep them close join'd at the Foot in a continued Line in the Depth of Water, and force of the Current which was at the Breach, that I could not therefore conceive, how the

same could in any Degree be depended upon, comparable to Dovetail'd Piles describ'd at Letter B, as above, which being enter'd at the Head, would keep close join'd to each other all the way down in the Water, and afterwards upon the Entrance into the Ground, by the needful Care taken to cut them with a Proper Snape for it, as in the Practice found requisite; it was upon Consideration hereof entirely agreed, That what

It propos'd, was preferable to the Method us'd by the *French*.

A Gentleman who had made his Proposals to the Trustees at one of their Meetings before, and attended that Day, desir'd a further time to bring his Scheme and Model before them, and a further time was appointed, and Brigadier *Richards* with the other two Gentlemen aforesaid (to whose Judgment, great Regard was observ'd,) were again desir'd, to meet for the Examination of what might be further offer'd by the said Proposer, or any other Person, and at their second Meeting, having wholly rejected what came before them as Deficient and Impracticable: They were again pleas'd (upwards of Thirty of the Trustees being present) to Confirm their Opinion of the Scheme which I had laid before them, without one Hand held up against me, as I have been inform'd.

WHEREUPON after the Trustees had thank'd the Gentleman who did them the Favour of their Assistance, and they had taken their Leaves, the Court came to the Resolution to Contract with me.

It being laid down in one of my Propositions (which were then before them) that I was willing to undertake the Work for the Sum of Twenty seven Thousand Pounds at my own Risque, and to give Security for the Return of all such Sums which I should receive in Case of my Failure in the Success: Or otherwise,

if

if the Trustees should please to agree with me, I was willing to procure five Thousand Pounds to be advanc'd by my Friends at their Hazard in case of my Work not proving Effectual, with which Money I propos'd to begin and carry on the same, until the said Sum should be expended thereon; And that the Trustees without Security, should then supply me out of the Publick Fund with what further Money should be necessary for the Performance. Upon which Terms I was ready to undertake the Work for the Sum of Twenty one Thousand Pounds, provided, that if any Unforseen Accident should Occasion the Expence of a much greater Sum, and the Work should at last be Effected, the Trustees, should then Recommend me to the Consideration of Parliament for a Reward.

A Debate hereupon arose, that since the Method which I had laid down and demonstrated to them, carried with it so great a Probability of Success, and that since the afore-mentioned three Gentlemen had fully declar'd their good Opinion, not only of my Scheme, but my Ability to put the same in Execution, whether it was not therefore adviseable to contract with me for the lesser Sum which I propos'd, whereby in Case of my accomplishing the Work without any Misfortune, a considerable Sum of Money would be saved to the Publick, or whether they shou'd agree with me for the larger Sum

Sum which I propos'd, whereby in case of my Failure in the Success, the Publick Fund would still be preserv'd; upon which Debates, the Trustees inclin'd to the latter, and it was at length determin'd, that a Proposition shou'd be made to me to recede from the Sum of twenty seven thousand Pounds, which I had demanded, and to contract with them for the Performance of the VVork for 25000 Pounds with security to be given them as above, and that upon my Consenting thereto, the Trustees should make me their Promise, that in case that I did effect the VVork, and it should afterwards appear, that by any unhappy Accident or Misfortune in carrying it on, the Sum which I contracted for should fall short, that then the Trustees should recommend me to Parliament, not only to enable me to discharge the necessary Engagements which I should enter into for the Performance of the VVork, but also for such Reward as the House should think fit.

AFTER the Trustees had determined in this Manner, I was call'd in and acquainted with this Proposition to me, which I readily submitted and agreed to: Whereupon the Articles of my Contract were accordingly ordered to be Drawn, an Abstract whereof is at the Latter end of this Treatise transcrib'd. I was inform'd by the Trustees at the same Time, that the Minutes of my Agreement being enter'd into their Books, the same was as binding on their Parts, as if sealed and

executed, and whilst my Contract was settling, I might go on and loose no time in Expediting my Work, I thereupon began to buy the necessary Timber, and Materials, and set a Considerable Number of Artificers to Work in a Yard which I had hir'd at *Rotherhith*, for the framing of a Sluice, getting ready my Dovetail Piles &c. and other Hands I got together without delay and set to Work at the Breach, to put forward and secure the same from growing any worse. A Slip having happened in the Walls of the Levels about that Time, which gave a Rumour in the Country of a New Breach.

BUT whilst I was thus proceeding, and my Contract was drawing and settling by Council, a Petition from Mr. *Boswell*, and several others, was presented to the Honourable House of Commons, Complaining of the Proceedings of the Trustees, charging them with giving an undue Preference to my Proposals, and alledging, that several able Mathematicians, who had consider'd my Scheme, had declar'd it to be altogether impracticable, &c.

HEREUPON I was oblig'd, in a great Measure, to neglect that due Application which was necessary, for the putting forward my Work at the Breach, and to give my Attendance at the House, whither I was summon'd to attend a Committee which was appointed to Examine in to the Matters charg'd in the said Petitions:

TOUCHING which, I shall chiefly here take notice of what was Insinuated or Charg'd against me, with relation to my Ability, in the Method I intended for the Performance of the Work. And for what was reflected on the Trustees, I shall pass by, as having been sufficiently Answer'd by themselves.

ONE of the Mathematicians mention'd in a Petition lodg'd against me, who attended at the Honourable Committee of the House, to bring his Objections against my Scheme, alledg'd, that it was impossible, in his Opinion, to drive down a Row of Dovetail Piles in one continu'd Line, in that depth of Water athwart the Breach, as was by me Projected, without their being born down and torn away, by the Strength of the Current setting in and out of the Breach.

UPON which he was ask'd by a Member of the Committee who was a Trustee, if he had discours'd with Captain *Perry*, or knew what Engines or Methods he intended to make use of, for Removing his Objection; he reply'd, that he had never seen or spoke with me, and being ask'd, if he had ever seen my Scheme, he again reply'd in the Negative, whereupon he was then further ask'd if he had seen the Breach, and he declar'd he had never been there. By this Gentleman's Replies, I observ'd, that his Objections made no Impression upon the Committee, nor needed any Answer from me; and indeed upon all the Scruples and Suggestions which were brought

brought against my Works, and upon the Examinations of the several Schemes and Propositions made by others, I did not find that the Objections which were raised had so much Force as to move the Committee once to enquire of me any Reasons in answer to them.

Particularly, I was order'd to be present when the Draught or Plan of my Scheme was laid before the Committee, and Description thereof was read, when also such Persons who had propos'd to make good their Charge against my Scheme, were summon'd to be present, and did attend, (at least some of them) but I do not remember that any of those Gentlemen objected to any part of what they heard read, or to the Plan which was laid upon the Table; only a Gentleman (who was a Member of the Committee) ask'd for a Model of my Scheme, which all the other Proposers had produced; upon which another Member of the Committee (who was one of the Trustees) answer'd, that I had no Model, and that I had never presented to them any thing at *Guild-hall*, but the Description and Plan which was then upon the Table.

Thus no Person could, or at least did maintain any rational Argument or Objection against the Method which I produced; on the other hand, the three before-mention'd Gentlemen, who had been desired to meet the Trustees for their Opinion, upon the Examination of Mat-

ters at *Guild-hall*, were twice order'd to attend in Parliament on the Subject of the Petitions which were lodg'd, particularly on the Day when my Scheme was appointed to be examin'd, and there again repeated their Opinion to the Committee, that there was no probability of the Breach being ever stopped, but by the Method of Dovetail Piles; and that if it was not found practicable to be done by such Method, it was impossible to be done by any other.

One of the said Gentlemen more particularly express'd, That he had seen and examin'd all the Schemes which had been offer'd, and did me the honour to say, That he saw no Scheme equal to mine, nor any other Person equal to his own Scheme; for that they had propos'd doing of many things, which upon their being examin'd, they were not found capable to put in practice: but in all the Questions they had ask'd me, I had answer'd them like an Artift, and like a Workman, and that therefore it was not only the Scheme, but the Man, which they recommended. Another of the same Gentlemen not only declar'd his Opinion with respect to what I had laid down, being the only probable Method of performing the Work, but went further, and said, That he verily believed I would do it.

However, the inserting this may seem to offend against the strict Rules of Modesty; yet it having carry'd weight with the Committee, and
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there being a Prospect of some other Things, in which I may be found capable of serving my Country, I thought I could not in Justice to myself, omit the Character those Honourable Gentlemen were pleas'd to give me.

THERE were also other Matters examin'd in the Committee relating to the regularity of the Proceedings of the Trustees, and some Debates likewise arose, whether the stopping of the Breach was at all necessary for the preserving the Navigation of the River. But the Honourable Members of the House who belong'd to the Royal Navy, declaring Their own Knowledge of the Mischief to the River that accru'd by the Breach, and Opinion of the Necessity of having the same stopp'd.

AFTER upwards of Ten Weeks was elaps'd and no one Point of Fact alledg'd, made to appear, the Committee was dismiss'd, and the House declar'd, by their Vote, that the Trustees had done their Duty.

THESE Delays and Obstructions prov'd unfortunate to me; not only because a considerable part of my own Time was expended in my Attendance on the Committee, which at my first setting out was more especially necessary to have been employ'd at the Breach, by Reason my Work was in a Method entirely new, and unexperienc'd by those Persons appointed to carry on the same in my Absence. But in the Inter-

rim of the Determination of Parliament, it happened that the Price of Timber and Iron Work advanc'd upwards of 20 *per Cent.* which prov'd some Disadvantage to me. Farther, all the while that Matters were depending in the House, the Trustees refus'd to Act, and it was not until the Eighth Day of *June* the same Year, that they sign'd the Contract made with me, or order'd any Money to be advanc'd to me: So that, on this Account my going on with my Work, which I however in some Measure ventur'd to do, that I might be in what forwardness I could, was deem'd by my Friends to be not without hazard of the Money which I expended thereon.

ON the whole, thro' these Hindrances, the Spring and the beginning of the Summer was in some Measure lost to me, and notwithstanding, that as soon as the House had confirm'd the Proceedings of the Trustees, I us'd my utmost Application to put forward the Work to recover the lost time, yet I found my self so streightned the ensuing Summer, that the Sun came to the *Equinox*, and the Days grew short, and the Weather precarious, before I could turn the Tides out of the Levels, which tho' I then succeeded to do, a very evil Accident accompany'd me therein; for before the Work was finish'd to its due heighth, upon an extraordinary Tide which happened on the 10th Day of *September*, 1717
the

the Water flow'd above what my Works were then rais'd to, and tore down the same to the Foundation, after the Tides had been only five Days turn'd out of the Levels, which cost a very great Expence and Labour again to recover.

THE manner of my Proceedings in carrying on of my Work, and the Occasion of the particular Misfortunes which I have met with, I will go on to give a more distinct Account of; which I am the more willing to do, to clear it from the wrong Imputations, and various misguided Notions which have been conceived of it; and, that other Persons may, by a true Light, be able to avoid the Mischief of any like Accident.

As soon as the House had confirm'd the Trustees in having done their Duty, I waited not for the Execution of my Contract, but directly entertain'd all the Hands I could get, and set them to work with the best Expedition I could, in the digging of a Canal, (for the Sluice mentioned in my Scheme,) and in the carrying on the Works for my Dam in the Breach, with Thoughts to have attempted the shutting in, and squaring the first heighth to low Water Mark the same Year, but when I came to dig down the Place for my Sluice, notwithstanding that I had (when I came within about 6 Foot of low Water mark) driven down large Dovetail Piles, on

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each

each side, and athwart the Place which I dug down for the most part upwards of 20 Foot into the Ground by extraordinary Engines for it, whereby to stop the Course of the Springs, which was done with large Beams of Timber fix'd a cross from side to side, to prevent the sliding in of the Banks, yet I found the Penetration of the Water to have that Force underneath the Dovetail Piles, thro' the Sand and bad Ground below the Moorlogg, * that the Pressure of the Water at the
Depth

* Moorlogg, is a vein of divers sorts of rotten Wood (Yew Timber only, which is found amongst it being not decay'd) which lyes about 3 Foot and a half, or 4 Foot underneath the Surface of the Marsh Ground belonging to the Levels, about 10 Foot in depth, and with very little mixture of Earth that can be discern'd amongst it; underneath it there is about 12 or 15 Inches depth of blew Clay, then Gravel and Sand. A great Part of this Moorlogg seems to be compos'd of small brush Wood, and many hazel Nuts have been taken up in digging, which I have had in my Hand and look'd to be firm, but upon a very little pressure they break to Dust. Some of the Yew Trees are found 14 or 16 Inches Diamiter and are perfectly sound, excepting the Sap; the Willow or Sallow Trees, are many of them found some of two Foot and upwards Diamiter, and retain a whitish Colour like Touch-Wood, and so decay'd (where they lye) that Men cut into it with their Tools, with more ease than they do the Earth or adjoining Moorlogg. But I have never seen any of that sort of Wood which others have describ'd, to be taken up Sound, and to moulder away upon its coming into the Air.

There have been found a little above the vein of this Moorlogg, *Staggs-berns*, particularly, my Men lately Loading of Earth into a Barge at Letter I, in the *Plan* of the
the

Depth which the Ground was dug down, being near Twenty-Two Foot Difference of Level upon the Spring-Tides, so swelled and lifted the Moorlogg in the Place for the Sluice, that it rounded up in the middle several Inches above the Level to which it was dug, and the Leakage began to take such power, that I thought it not safe to open the Ground any lower,

the Level prefixed, found a *Stag's-born* of a middle Size, the largest Part of it quite rotten, and mouldered to Dust in taking up, and other Parts honey-combed and rotten; and the small Branches near the Tip (of which I have two by me) one of ten Inches, the other of seven Inches and a half length, are heavy, and the most part sound. There likewise was another *Stag's-born* found some Years before my Undertaking, about half way between the aforementioned Place, and the Mouth of the Breach.

From what Cause, or by what Means, this Thickness of Moorlogg, which is found underneath the Surface of the Marsh-Ground (as described) has been produced, and generally lies in even and regular manner, being nigh six foot thick above in the *Thames*, at *Depford*; where Capt. *Bronsdon* lately repaired his Docks in *Woolwich-Reach*, over against the *Ballast-Wharf*, between seven and eight foot; in *Plumsted-Levels*, against *Barkin-Creek*, nine foot; and gradually of a greater Thickness as well as Breadth, going down on both sides of the *Thames* below the Breach, as the Marshes extend; the Thickness of the Marsh-Ground, which lies upon it, being near alike, and none of it to be seen at any Place where the Course of the River cuts into the Highland (as at *Woolwich*, *Eritb*, *Purfleet*, &c.) I say from what Cause this has been, I will leave to Gentlemen who may employ a Thought this way, and will omit my own Opinion in this Place, with what other Observations of the like kind I have made in Foreign Parts.

lower, and submitted to fix the Foundation (or Apron) of the said Sluice, to a less Depth than I would willingly have fixed the same to; and consequently as I could not place the Sluice to a greater Depth, there could not, in the Course of carrying up my Works in the Breach, be given so great an Ease and Vent to the Water, by way of that Canal, as was necessary; the Top of the Apron being fixed only to within a Foot of the Depth of the ordinary Low-water Mark in the *Thames*, which would have been of much more Service and Satisfaction to me, could the same have been carried lower.

This Reason, together with the Observations which I made upon the Advance of my Dam in the Breach, that the Force of the Stream in the Breach, as the Works were carried on, and the Passage became contracted, began to operate with great Violence, led me, for a greater Security of my Work being effected, to alter my first Intentions of making but one Canal, and thereupon resolved to dig another, and to fix down a second Sluice to what Depth I could obtain. And that until I could have the Advantage of both Canals, for the greater Ease of the Water running in and out of the Breach, not to attempt the close of my Dam, lest I should be under any Difficulty therein, particularly doubting whether I should be able to draw off the Water low enough by
the

the Sluice, which I had plac'd to lay the Surface of my Works dry after I had clos'd my Dam.

AND it being the spring of the Year 1717. before I could finish the Second Sluice, and compleat the opening of that Canal, which I found equally difficult in the fixing down that Sluice as the first, so that tho' I carried the Foundation to a considerable depth beyond what was possible to have been done without the said Drift of dove-tail'd Piles, yet found I durst not venture the fixing of the Apron of either of them below, or fully to the depth of low Water-mark, lest I should have been over Power'd by Springs and Leakage.

By these Obstructions, and also by a considerable Frost and drift of Ice, which happen'd that Winter, I became backward in my Work, and could not make the Close of my Dam to low Water in the Breach, until the beginning of *June*, 1717. and then the Time near approaching, according to the Letter of my Contract, for turning of the Tides out of the Levels.

SOME of my Securities became uneasy on this occasion, particularly a near Relation of mine, apprehending that I should be driven upon the Winter Season, before the Tides could be
turn'd

turn'd out of the Levels, which was look'd upon must be attended with evil Consequences, so that I was by Importunities and Disorders arising, press'd forward, to neglect those principal Rules, which I had laid down in my Scheme (as absolutely necessary for doing the Work,) namely, the Composing the Body of my Dam, with such good Earth or Clayie sort of Ground, as was near at Hand, with also the neglect of some other Points, which I shall mention, and blame my own Conduct in submitting to.

FIRST, As to my departing from my Judgment, laid down in the 5th and 12th Paragraphs, of the Description of my Scheme, and suffering the Dam to be at all Rais'd with worse Earth than I had determined: There is every where upwards of 3 Foot deep from the Surface of the marsh Ground, in the Levels belonging to the Breach, very good Earth or Clayie sort of Ground for the purpose of making of a Dam, but then there is near a Foot deep of bad Earth, underneath that which is good next to the Surface of the Moorlogg, and in other Places a good deal of soft Earth or Mud, which since the Breach where the Current has not been strong, has settled and lodg'd upon the Surface of the Marsh Ground, by the Circulation of the Waters, in and out of the Levels, and altho' I gave strict
Dire-

Directions from Time to Time, not to suffer any bad Earth to be brought into the Dam ; yet being obliged to work, in carrying up of the Dam by Night, as well as by Day (as the time of Tides happened) and having, for the sake of Expedition, agreed with the Men, to dig and carry the Earth by the Tun (it being observable that they worked two or three times as much by Task-work, as by the Day, or by the Tide) for the ease of their Labour ; they wilfully brought soft and bad Earth to the Works, especially in the Night, mixed more or less with that which was good, as they found they could impose it ; and the Practice of this still grew worse and worse, as they found me necessitated to put forward my Works, notwithstanding the pressing Orders I repeated to my Assistants (who were five in Number) that they should not suffer any bad Earth to come into the Dam. And finding my Directions, in this Particular, not comply'd with, and that generally the Earth was so soft, that a Man, stepping upon it, would sink over his Shoes (as many of my Friends do remember) I then, upon my own more strict Inspection into it, ordered all such Barges, wherein there was a mixture of any such bad Stuff found, to be turned away from the Works, to throw it into the Water, and to abate the Men of their Wages who brought it : upon which, Disputes and Mutinies frequently arose, the Men vouching the Stuff which they brought to be good ;

good ; and when I order'd it to be turn'd away, and thrown into the Water, would put on their Clothes, and leave off Work for several Days together. Whereupon, my Assistants (particularly a Person, who I had more than ordinary Reason to depend on) being influenced by misguided Notions, that the bad Earth I objected against was not so necessary to be regarded as putting forward the Work, join'd in endeavouring to persuade me to a Compliance with my Men.

I found all my Assiduity and Care not to have sufficient Effect, and the Evil encreased upon me, when the Men came to work again ; which obliged me to make still stricter Orders, not to pay them any thing for such Freights with bad Stuff, which they brought on the one hand, and raising their Wages, for bringing to the Dam, what should be good on the other ; whereby they could some of them earn, and were paid, as appears by my Books, from Thirty to Thirty-six Shillings *per Man per Week* : still this did not divert them from imposing upon me, but they grew more idle and disorderly, as they had more Money to spend, and frequently would, One and All, (as they called it) leave off Work, insisting on more Wages, at the time when they saw my Necessity to be the greatest, which was at the time when the Dam was raised more than half
Tide,

Tide up, and the Water upon its Flux and Reflux, set over the Works with the greatest violence.

INSTEAD of my suppressing them, by not giving way to them, which I was of Opinion to have done, by letting the Work stand for a while, I found my self the more strongly Press'd to submit to the Practices of my Men, the Opinion of my Assistants being urg'd, and the general vogue of Men that my Work was carried on in a sufficient Manner, and only wanted to be Expedited before the Winter came on, and all that I could say of my being apprehensive of the soft Earth spreading, as the weight of the Dam encreas'd upon it, and that I believ'd it better to be backwards a few Weeks in respect to Time, than to comply with any Evil in the carrying it on, this was imagin'd to be only a Humour in me, to find fault without occasion (as 'twas Term'd) and I found my Assistants, so wrought upon by the Influence of my aforementioned Relation, who had a Son in the House with me, that upon my insisting on a strict Observance to my Orders, (tho' they seem'd to give Ear to me) they determin'd amongst themselves, not to mind my blaming their neglect, but to let the Work go forward.

AND

AND it being a prevailing Opinion drawn from the Practice of all the Undertakers, who had gone before me, that nothing but a great Number of Hands would be wanting to make a Push as it was call'd, to turn the Tides out of the Levels.

I found my self from these Notions press'd on all Sides to get a greater Number of Men together, and in Conformance to the general Desire of my Friends in this Point, I made Application to the Right Honourable the Lords of the Admiralty, and had the Favour of Men order'd from his Majesties Yards of *Deptford* and *Woolwich*, I also rais'd all the Men round the Country that I could gather together, for turning the Tides out of the Levels, which was done at the time of the Neap.

WHILST I was thus proceeding, I remember a Gentleman in an Eminent Station in his Majesty's Naval Affairs, who did me the Favour more than once of coming to see my Works, advis'd me not to go on in such Haste, but to give the Earth in my Dam due time to settle before I attempted to turn the Tides out of the Levels, whose Opinion it had been happy to have follow'd.

MY

My Dam had hitherto from the Foundation been carry'd up by Set-offs on each Side, of about seven foot in breadth, made by a drift of small Piles, at the height of every three foot, or something better, with Boards or Planks nail'd on the Sides of the Piles, as the Works were rais'd, and so much Earth as was fill'd, or laid on the Dam, every Tide, was constantly cover'd over at the top with Reeds and Hurdles, to prevent the same from being gull'd, or wash'd away, by the Water setting in and out of the Breach. But upon the turning of the Tides out of the Levels, at the time of the Neap, a naked Wall of Earth, without any Piles driven, Boards on the Sides, or covering on the top, was propos'd by one of my Assistants to be carry'd up, by the great number of Hands there was for it, faster than the Spring could be apprehended to rise upon us; and, in conformance to the Expedition so much press'd to me, I agreed to this Method, in the hopes of Success.

BUT when this Bank, or Wall of Earth, of a narrow breadth, came to be carry'd on in the middle of the Works, to about four foot height, and a Space, according to the main breadth of the Dam, left on each Side, about twelve foot, the Weight of this Wall, as it was laid upon the Dam, continued settling directly down into the

soft Earth, in such manner, that before the same could be advanc'd to a sufficient height, I was surpriz'd with an extraordinary Tide, occasion'd by a Storm at N. W. the Sun being in the Equinox, and the Moon a Day after the Full; which Tide flowing above half a foot higher than the top of the said Bank of Earth was rais'd, the Water soon wash'd down the same, and, as it gain'd room, so encreas'd its Weight and Power, that, in less than two Hours time, where it first went over, it tore down the Body of the Dam, until stopp'd by the heads of the dovetail Piles, which were driven into the Foundation: whereas, had the Earth happily been laid on by Set-offs in height proportionable to the other Parts, defended with Piles and Boards, and cover'd over at the top, in manner as the other Parts of the Works were carry'd up, which prov'd sufficient, when the Water pass'd and repass'd every Tide, with much greater force and fall; in all appearance the Work would have sustain'd no Damage from so thin a Body going over at the height it was then rais'd to, and there had been opportunity, with the number of Men, which I had at that time, (being upwards of three hundred) to have added new Matter and have rais'd and brought the Work into sufficient Security, before another Spring came on; especially

especially had the Earth been good which was put into the Dam, (as laid down in my Scheme) the Mischief had more easily been prevented, and the Work, at my first Endeavour, been happily compleated.

THE Difficulties and Accidents which I have met with, having occasion'd various Opinions and Reports, that my Works have been blown up, through not being secur'd at the Foundation, or born or broke down by the Force of the Tides for want of due Strength; I therefore think it proper here to take notice, *First*, that my Work has always been effectually secur'd from blowing up, or any Penetration of Water passing underneath the Foundation or Bottom of my Dam, by the Drift of dovertail Piles, &c. (as laid down in the Description of my Method, which was examin'd by the Trustees) and as has been evident to every Person's Observation, who has seen the Work.

AND touching the other Suggestion alledged, I must desire the Favour of the Reader to look back to the Description of the Nature and Pressure of Water, which is before laid down.

I HAVE shewn in treating of Mr. *Boswell's* Sluices, that the Weight of Water lying against any Thing, is always to be computed from the height, which the same rises or is penn'd up to. We see by the

Practice of Boys and common Paviours in the Streets, that a very little Matter, (though laid upon Stones, which are a guide to Leakage) will make a Dam with Dirt, that will pen up a Foot of Water. And again, for the making of Gentlemens Ponds, or to pen the Water out of Meadows, where the Rise of any Flood is not known to be great, a very small Bank in breadth is sufficient for the height of three or four foot; and if the height be five or six foot, then the magnitude of the Dam must be in proportion increas'd, with the best of Earth to be sought for it. And it is certain, that no Weight inferior, where the Motion is gradual, or without Velocity, (as is the Rise of Water by the Flux of the Tide) can force or bear down a Body superior. And to clear up the aforesaid Aspersion of my Works being broke down by the Tide, for want of due Strength, I will here compute the Weight of Earth, which my Dam was compos'd of, and the Weight of Water which lay against it.

THE height which my Dam was raised to, at the time of turning the Tides out of the Levels, (as before related) reckon'd from the bottom of the Breach, in the deepest Place, to the top of the Works at the said time, was 35 foot, and the breadth at the bottom of the Breach was

150 foot; and at the height the Foundation was made to above the Low-Water Mark 104 foot, and at the height to which the Work was carry'd, to the turning of the Neap Tide out of the Levels, 36 foot: upon which breadth the narrow Wall before mentioned was attempted to be raised, for compleating the Work to its full height of 42 foot design'd. Now without computing any thing for the aforesaid Wall, which was irregularly made, let the 36 foot breadth at the top, and the breadth of 150 foot at the bottom of the Breach; in the deepest Place, be added together, and take the half thereof 93, the mean breadth one with the other, and multiply it by 35 the Depth, and the Sum will be 3255, which is the Quantity of cubical Feet of Earth and Chalk together, contained in one foot length of the Dam made a-cross the Breach; and every foot of Earth being supposed to weigh about 96 Pounds, (or one Third more than what Water weighs) the whole weight of Earth, for one foot length of the Dam at the deepest Place, (as before mentioned) will be 312480 Pounds; or, divided by 112, makes 139 *Tuns*, 10 *Ct.* and proportionable for the rest of the length of the Dam. Again, let the weight of Water be computed at 4 foot greater height than is done for the Dam, or 39

foot in Depth answering to the full Height that the Tide rose, which went over the foresaid small Dam or Wall which was rais'd upon my Works; and according to the Principles of computing the Weight of Water laid down in the former part of this Treatise by the Triangle *A*, let the said Depth of 39 foot at the deepest part of the Breach be multiply'd by 19 and $\frac{1}{2}$, which is the half Depth of the same, and the whole Quantity of Cubical Feet of Water pressing against the Dam for one Foot in Length cross the Breach, will be $760\frac{1}{2}$; and multiplying the same by 64, the Weight of one Cubical Foot of brackish Water gives 48672 Pounds, and divided by 112 makes 21 *Tuns.* 14 *Ct.* 2 *qr.* 8 *l.* which proves, that the Weight of Earth of which the Dam was compos'd was more than 6 times superior to the Weight of Water pressing on the Outside of the Breach on the Day when the Accident happen'd, without taking notice of the Wall of Earth rais'd upon the Dam, or the Counterpressure of about 26 foot depth of Water, which was on the Inside.

HAVING thus shown how much superior the Earth in my Dam was to the Weight of Water, as well as answered the other Objection before suggested; I will now go on to relate my Proceedings in Repairing the Damage sustain'd.

IT happen'd to be, in the Day-time, and my Men in full Work, when the Tide before mention'd was observ'd to rise much faster than it had been known, in all the time of my Undertaking before; and being very apprehensive of the Mischief that must ensue if the Tide went over such a green Bank or Wall of Earth, I got small Piles drove, and Boards set on edge from end to end, to be a Fence to the Tide above the Height to which the Wall was rais'd. But unhappily this met with no Success: the Water, when the Tide came to rise, penetrated underneath the Boards, which were in some places ramm'd with Clay, and in other places defended with Sails, to prevent it; and finding immediately that the Water took such force, that it was past remedy to prevent its being tore down as low as the Works were first made above the Low-Water Mark, therefore I order'd the said Boards instantly to be cut down in two other places, whereby to give the greater Ease to the Fall of the Water: for otherwise, only operating in one place, where it first got power, the Mischief must have followed, either that the Water would have worn so much towards one end of the Dam, as to have got behind or beyond the Row of Dove-tail'd Piles driven in the Foundation, and have made such excessive Depth there, that could not have been recover'd without the Augment-

tation of a very great Expence ; or at least had it not gone beyond them, the continued Violence of the Current setting in and out of the Breach (when confin'd to a narrow Passage) must have broke down the Dove-tail Piles, and tore away the Foot-Wharfs and Foundation of the Works to such a Depth, that it would have been very difficult to have found hold in the ground to drive new Piles for making good the Damage sustain'd : It being always true, that where any River or considerable Body of Water sets in or out of any Place that's streightned or pent up, what it wants in the Breadth, it labours with the greater force to make its own way in the Depth ; and where the Ground is bad, as in the place of my Works, the Mischief must have prov'd much greater than it did, had it not been prevented by the immediate Application before set forth, and continu'd on for several Days after, by keeping as many Men as could be employ'd every Tide as the Water ebb'd off, constantly in cutting away the Timber-Work, and digging down such parts of the Earth in the Dam from end to end, which did not suffer by the Accident, until by this means the Passage of the Water, with the help of the Sluices being open, began to run smooth and easy. Besides which, in the place where the Water first took power, I kept throwing

ing in several Freights of Chalk, to keep the Water from wearing too deep by the Fall over the Dove-tail'd Piles on the Reflux of the Tide; and to save the Foot-Wharfs from being torn to pieces, which nevertheless sustain'd some Damage in the Place aforefaid.

FURTHER, altho there had been no Necessity to cut down the Works for the Reasons above, yet it was impracticable to have repair'd the same again while one part remain'd standing higher than the other: Therefore I was obliged to continue to cut down and level the same to within a foot or a foot and a half of the height which the Dam was first built to, above the Low-Water Mark, whereby to facilitate the raising and building the same up again, according to the Description of the Method laid down in my Scheme: The more particular Reasons for the Necessity of which, I thither refer to.

HAVING as much as possible thus prevented the Extension of the Evil by this Accident, I will go on to give an Account of the Repairs; and having been very particular in my Relation hitherto, that I might give Persons of Judgment a better Idea of the Work, I shall have the less occasion to be tedious in what follows.

IT was one great Advantage and Encouragement in this Misfortune, that my
Sluices

Sluices (which were not calculated or suspected to have any occasion for the Service of them any more than once to have turn'd the Tide out of the Levels) that they stood firm in this Shock, and were able to answer the End of their Service again with very little Repair and Additional Work on the *Thames* side, where the Return of the back Water had went out at the time of raising the last part of my Works, with a Fall of at least seven foot for some time, and had worn away the Ground to a considerable Depth.

DURING the Winter-Season which follow'd, having made the necessary Repair to the Sluice, with the Damage to the Foot-Wharfs in the Breach, and made some additional Breadth to my Dam by a new Drift of Piles on the *Thames* side, to give the better Ease to the Fall of the Water on the Tide of Ebb, as was observ'd necessary in raising the Dam the first time : I proceeded early in the Spring of the Year to raise my Works in the same method, but with much better Earth, and a much less Number of Hands than I had employ'd the Year past. I met with the like Strugglings from my Men to advance their Wages as they had done before, and they more than once desisted from working for some Days to have forc'd me to new Terms : but having fixed a good Price of
Wages

Wages to them from the beginning for the bringing in of good Earth, and upon their Attempts to bring in that which was bad, strictly rejecting it, as often as such Imposition was offer'd, they were kept to good Order, and the latter End of *June* the Tide was a second time turn'd out of the Levels in the time of the Neap, as before, Only that the Work after the Tides were turn'd was now continued to be rais'd by Set-offs with Piles and Boards, and well covered over at the top; so that tho a thin Body of Water of about a foot depth or more, did several times in the ensuing Spring-Tides pass over into the Levels, it was easily let off by the Sluices, and there ensu'd no manner of Evil therefrom. And after I had further rais'd the same by adding two other Set-offs, I then gave notice thereof to the Right Honourable the Trustees, who were pleas'd to appoint a Committee to come down at the time of the second Spring-Tides, which happen'd after the Breach was clos'd: which Committee having upon their View made such Observations as they saw requisite, were pleas'd to make their Report, That I had effectually perform'd that part of my Contract as stipulated to be observ'd upon the making such View, which was about the 20th Day of *July* 1718.

AFTER

AFTER which View, I immediately began to dam up the two Canals on the Inside of my Sluices, and continued at the same time to raise and add more Earth on the Dam in the Breach, as it was found to settle, and as a new Body of Earth was natural to be expected.

WHEN the Dams in the Canals were advanced, and the settling of the main Dam in the Breach was found very much to abate, and being covered over with Reeds and Hurdles at the top, in more exact and effectual manner than Time and Opportunity had ever admitted in carrying up of the Works; so that tho an extraordinary Tide should rise above what they were then rais'd to, no Danger of any Mischief might happen therefrom.

BEING under a Promise to my Lord *Aylmer*, made some Months before, to go down to *Dover*, to give him my Opinion of what Relief might be found to the Inconveniencies attending that Port, and his Lordship having writ to the Trustees there to give me Assistance in making my Survey; I left the Care of my Works at the Breach to be carry'd on in my absence by my Assistants, and about the 22d of *August* took my Journey thither, being at the time of Neap Tides, which I chose for it.

THE Report which I made to my Lord of the Improvements which I found that Har-

Harbour capable of, for rendring the same practicable for large Ships: to go in and out, and to lie always afloat with their Lading, I have hereafter transcribed, as being a thing tending to the common Welfare.

IMMEDIATELY upon my Return from thence, I was visited with an intermitting Fever, or Ague, which was very rife at that time; and after staying a few days at the Breach, and the Increase of my Distemper being look'd upon dangerous, I was press'd by my Friends to go up to *London* for my Recovery. Thereupon my Assistants, and one of my Securitys, who took upon him to be at the Breach, promised to take care of the finishing the Work in my Absence.

DURING the Time of my Illness I was often inform'd by Messages from my Assistants, and by my Friends who came from the Breach, that the compleating of my Work went on in very good order. And about a Week before the last Misfortune that happen'd, when I was upon my Recovery, I desired a Gentleman who was my particular Friend (the Equinoctial Tides being then past) to go down and enquire how the Tides had been, and to bring me up an Answer to several Points which he took in Writing: amongst other things one was, How much the Great
Dam

Dam had settled upon the laying on an Addition of Earth, which was near finishing at my coming away. And the Answer which my Assistants return'd (as the Gentleman took it in Writing, which I have now by me) was, That it had settled nothing perceivable.

I shall not here enlarge upon the other particular Points, but only take notice, that if the Report of the Works not settling was true, then it was easy, with the Number of Men there were for it, to have rais'd and kept the same covered to such a Height, as might have been out of all danger.

HOWEVER, two or three days after this Account, the 25th of *Septemb.* 1718. finding myself gather Strength, I resolv'd to go down to the Breach; but my Friends who were my Securitys, at a Meeting which they had on the same Day, urg'd and pleaded with me not to go down, telling me that I might be satisfy'd that what was necessary was taken care of, and that they apprehended there was evident danger of my Relapse, if I went down upon the River before I was better confirm'd in Strength; and desir'd me to desist from my Resolution for a Week, when some of them would accompany me to the Breach. But to my great Surprize, on the last Day of that Month early in the Morning, I had the

the unhappy News brought to me, that between two or three Hours before Day, a high Tide, which flow'd six or seven Inches above the lowest Part of the great Dam in the Breach, had cut down and destroy'd the same, in such manner, as was apprehended could never be recovered: Upon which, I made all the Haste thither I possibly could; it was about three Quarters Flood, the next Tide after the Damage, when I arriv'd; and finding both the Sluices shut, and the Dams standing in the two Canals, one of which being near finish'd to its full height, and no place cut or broke down of the great Dam, to give Vent and Ease to the Passage of the Water, which set in and out of the Place where the Mischief happen'd with inexpressible Violence; I immediately sent to all the Villages, where any Men could be found, and set them to work, to uncover and dig down the standing Parts of the great Dam in the Breach; as also to make way and cut down the Dams in the two Canals, and open the Sluices, as soon as I could.

BUT by reason what was necessary of this kind had been wholly omitted the first Tide, when the Fall of the Water was very great, and would with but a very little vent have made its own Passage wherever it had been let loose, as was
seen

seen by the Operation of the Mischief the Year before, and might have been remembered by the Persons to whom the Charge of the Work was now left; Notwithstanding all my Application upon coming down, the Weight and Force of the Current continued so great, where the Mischief first took its Power, that the sixth Tide after, the Row of dove-tail Piles, originally driven in the Foundation, with the Foot-Wharfs which were made, and bound on each Side with a double Drift of other Piles, were near an hundred foot in length of the Dam, torn up and driven into the *Thames*; and before the remaining Parts of the Dam could be cut and dug down to a sufficient depth, to make the Current tolerable easy, the bad ground continued for several Weeks wearing away; until, in the place where one of the Foot-Wharfs was broke down, there was near 20 Foot greater depth of Water, than when the Work was first begun: altho', besides what is related to be done, as above, to ease the Force of the Current, there were considerable Quantities of Chalk daily thrown in, which was a great Help in preventing the Ground wearing deeper.

THIS Application was continued with a very considerable Expence, before the Work was put into the needful Security from growing worse, which was done
with

with some Addition of driving of new Piles at the broken Parts of the Foot-Wharfs, and sheeting and filling them up with Chalk, &c. Without such Means used, the Difficulty and Expence in a future Repair must inevitably have proved much greater, or perhaps not practicable to have been recovered at all, so as to have driven new dove-tail Piles in the place of those broke down, and to join them and the Foot-Wharfs in the same Line with the Parts of the Work which remained standing; and even in the Condition the same was preserv'd to, it was doubted by many Persons, whether it was practicable to be recovered, or not, without beginning in a new Place.

UPON my coming down from *London*, and enquiring of my Assistants how, or from whence this Mischief took its Rise, they told me, that the Tides did not flow above six or seven Inches higher than the Works; that the Earth at the top was as well covered over as ever it had been done, and could not rightly know or judge from whence the Mischief proceeded; for the Watchman, who had the same repeated Orders given to him, as before I went to Town, That in case he should observe any likellhood of a high Tide, when it flow'd within two or three foot of the top of the Works,

that he should not fail to come and call them out, to give their Attendance at the Time of High Water, as had been constantly observed upon other Spring-Tides; but that the Watchman appointed near the Place, where the Damage then happened, never came, nor gave them any notice of the Flowing of the Tide, until it was High Water; and the Tide went over the Works about the Depth before-mentioned, as near as they could judge: That they heard the Water run over the Works at the old Booth, or Place where they lodg'd, at the time when the Watchman call'd them up; and when they came to the Dam, one of them, who first got there, it being a Moon-light Night, took a Bundle of Reed with him, and ran to the Place where he saw the Water had made its Passage underneath the Hurdles, in hopes to have apply'd some Help, but found the Earth so much gull'd and torn away, that it was too late, and that the Water began to take such a Force, that he durst not venture back the same Way which he went on upon the Dam, lest he should have been born down by the Stream. Whereas had he, with other Help that was upon the Spot, been call'd out sooner, before the Tide was risen to the top of the Works, they could timely have observ'd any Mischief, that might have appear'd,

appear'd, and, by the Application of Reed or Earth, have prevented any evil Effect.

WHETHER this Misfortune took its Rise from any Leakage, or whether the Hurdles were made loose, or how the Water came to gull the Earth, which they cover'd from underneath them, is not known; it is however evident, that there was a Neglect of Duty on this Occasion: either the Watchman must have been awake upon the Works, and did see the Tide rise higher than his Orders was to have done, before he call'd, or gave notice thereof, to my Assistants; or was asleep, or absent at an Ale-house, that was near: which I am the more inclinable to believe, being unwilling to think, there was any Wickedness purposely committed.

ABOUT a Fortnight after my Return to the Breach, when I had set my Men in full Work, having occasion to go to *London*, and believing my Friends would be enquiring of me about the Accident, I ask'd the Watchman some Questions concerning his Neglect; but finding that he gave his Answers indirect and evasive, I desisted from questioning him any farther, designing, as soon as my principal Assistant, who gave him his Orders, and was gone very ill to *London*, four or five Days after the Accident, should be recovered, to have had him to a Justice of the Peace to

be examined; but when I was gone to *London*, he went off from the Works the next Day, leaving his Wages behind him, and was not afterwards seen, or heard of, till very lately, when I procur'd him, by Warrant, to be brought before *Mr. William Blacbourn*, Justice of the Peace for the County of *Essex*, and one of the Trustees, before whom he own'd upon his Examination, that his Orders were, that in case of his observing any likelihood of a high Tide, to call out to my Assistants, when the Water came within two or three Foot of the top of the Works, for them to attend at the Time of High Water, and which he own'd had often been done at other Times, both in my Absence, and when I was my self at the Works. Upon his farther Examination, he said, that he did not the Night when the Damage was sustain'd go to call out any of my Assistants, till the Water was up to the Reeds, with which the top of the Works was cover'd; that my Assistants, upon the notice he gave them, immediately hasten'd to the Place, and that when he came back, though he did not stay any where by the way, then the Water ran over the Works; and that my Assistants came there as soon as himself. Upon his being farther examined, why he did not call them out sooner, as was his Orders,

Orders, he own'd that he went off the Work when the Tide was flow'd about half-way the height of the Wall or upper Off-set, which was within 2 foot or 2 foot 3 inches of the top of the Works, which he made pretence was to pump Barges, and that when he return'd he found the Water rose to the height before mention'd.

My Assistants depos'd at the same time, That he was order'd to call them out upon the Rise of any Tide to the Height which he had acknowledg'd ; That he had no Orders at all from any Person to pump any Barges, and that there was not any for him to pump, nor possible for him to come at any in the Place where they lay moor'd without swimming to them, at the time of the Tide which the Watchman own'd he went off the Works ; which is to be observ'd was the very Time, which he in the fore part of his Examination declar'd his Order was to have given notice of the flowing of the Tide to my Assistants, and should not have gone any other way ; and which my Assistants farther depos'd, That had they then been call'd up, as they had been at other times, before the Water was up to the top of the Works, they verily believ'd all Mischief might have been prevented.

UPON his being examin'd why he went away from the Breach without giving any

Notice, or making any Demand for his Wages at his going, or afterwards coming or sending to demand it, he said his Reason was, because he believ'd he should not have it paid him.

I shall not here mention any more of this Examination, which I have by me, under the Hand of the aforesaid Gentleman, but proceed in my Account of finishing the stopping of the Breach.

THE Money which I had receiv'd from the Trustees was very near expended by the time the Work was put into proper Security from growing worse, as before described.

ABOUT *Christmas*, the same Winter I humbly apply'd to the Trustees for the Favour of their Assistance, there then remaining in their hands 4000 *l.* part of my Contract, which was to be paid me upon the removing of the Shelf without the Breach, which I had been at considerable Expence to remove, and wanted but very little of being effected: but the Trustees then, and upon a second Application which I made, refus'd to order me any more Money, tho I propos'd to give Security for the Repayment of it, if I did not go through with my Undertaking.

AND upon the Estimate which I afterwards produced to my Securitys, that it would require between 6 and 7000 Pounds.

to make good the Damage sustain'd, I found great difficulty to unite them to raise a Sum amongst themselves for it; and had not my good Friends the *Russia* Merchants, who knew me in the *Czar's* Service, stood firmly by me, it is certain I should never have been able to have gone through with my Undertaking.

IT became now a Question by those who declined to advance Money, Whether the Method I proceeded in was proper? and there were many Proposers and new Schemes now set up for Repairing the Work in a different manner from what I had laid down in my Estimate.

BESIDES the Models and Propositions offer'd by Strangers, there was a new Model privately made by a Person that was near to me, and some of my Securitys were desir'd to meet to view it when I was at the Breach; whereby it was propos'd that the Earth in my Dam should have been but 30 foot in breadth, and to have had more Chalk used in the Work in the room of it; Reasons being advanced by the Persons who supported this new Model, that Chalk was preferable to Earth: but when the same came to be examined, the Arguments used were easily refuted by the proper Objections which my Friends made to it without once requiring my Opinion in it.

WHEN the Disputes about the Manner of carrying on the Work were over, the Majority of my Friends came to a Resolution to raise a sufficient Sum of Money to enable me to compleat the Work, and to make Representations to the Trustees of such Persons who refused to come into Measures with them: and tho some of my Securitys declined paying any Money, and continued to be troublesome to the rest, yet about the beginning of *February* Money was rais'd to begin upon Repairing the Damage done to the first Height my Works were made above the Foundation, which I forthwith took in hand; but by reason of the great Depth of Water and Labour in making good the same, together with the Backwardness of some of my Friends to furnish the needful Supplies of Money, it was not till *September* following that I made some Repairs to my Sluices, compleated the Foot-Wharfs, and made a Close by a Drift of Dove-tail Piles in the Foundation of my Dam to the height above the Low-water, as had been at the first done. And before the whole place of the Damage sustain'd was squar'd and fill'd up with Earth to the aforesaid height, the greatest part of the Winter was expir'd.

EARLY in the Spring I began to carry up the Works for turning the Tides out of the Levels. Thro the difficulty of finding
good

good Earth, which was now at a greater distance to be brought than at the other times of raising my Works, and by some Neglect in the Covering of the Earth with that Care as ought to have been done, when the Dam was carry'd about two thirds up, and the Force of the Tide past in and out with the greatest Fall and Violence, I met with an Accident that gull'd away the Earth in such manner, that was very neat obliging me to cut down and level my Dam to the height that the same was first made to above the Low-water Mark. Also I had another Accident which had like to have proved very mischievous to one of my Sluices; but however, by timely applying of Remedy, all Misfortune was prevented, and on the 18th of *June* last the Tide was the third time turn'd out of the Levels: The Work being carry'd up with good Earth by proper Off-sets, and taking the Time of Neap-Tides for it, as had been done before.

WHEN the Tides were turn'd, being able then to do the Work which remain'd in the Day-time, without attending the Tides in the Night, I doubled the Watch in the Places necessary, and order'd my Assistants likewise to take their Turns to look out in the Night, at all Spring-Tides.

As the Body of Earth, in the Dam settled, I continued a sufficient Number of Men to raise and gain upon the same, till I was above the Height of the Common Spring-Tides, and then set Hands to work to make the Dams for stopping up the two Canals; and by a constant Attendance in raising them, as well as the main Dam in the Breach, I advanced them the same Summer to such Height and Perfection, that the extraordinary Tide which happen'd in the Month of *November* last, occasion'd by a Storm of Wind, and the Moon's being then in her Perigee, or nearest Approach to the Earth, (which is always observ'd to have a strong Influence upon the Tides, either at the Full or the New) did not rise to the Top of my Works by near a Foot.

THE Builders in the River of *Thames*, whose Business of docking of Ships, &c. obliges them to be very mindful of the Tides, tell me, That the aforesaid late Tide exceeded any that has been known in their Memory; and the Damage that was done at that Time, by the overflowing of the Banks, more or less, of all the Levels in the *Thames*; and having made a Breach below *Erith*, and in two Places between *Grays* and *Gravesend*, (which, by timely Application, have been recovered) together with the Damage in many Places not yet fully repair'd in the Hundreds of *Essex*, &c. abundantly confirm what those who
 have

have made their Observations in the *Thames* relate.

I have since, nevertheless, continued to raise and augment the Strength of my Dams, to a Substance and Height beyond the Banks in any other part of the *Thames*, being upwards of 4 Foot and a half higher than at the Time of the Damage in the Year 1718, and near 2 Foot above the late great Tide, and which do not now settle any more that can be discerned: also I have so finish'd and compleated all the other Parts of my Contract, as, I hope, will be entirely satisfactory to the Trustees, (whom I expect to make their View in a short time) as well as effectual for preserving the Navigation of the River from danger any more for ever, where the Breach is now stopp'd.

As I have spent upwards of 5 Years of my Time in the Performance of this Work, and have met with so many adverse Accidents, that I have been obliged three times to stop the Breach, attended with more than common Labour; and whereas, had I succeeded the first time I turned the Tides out of the Levels, I had both been exempted from all the Difficulties I have since met with, happy in having a sufficient Compensation for my Labour in it, and have gone a great way, by this time, in performing some other Work: So, on the contrary, the Weight of my Misfortune, is so much the heavier upon me, not
only

only that I have expended my Time and Labour, but have moreover been obliged to enter into very considerable Debts and Engagements, to enable me to compleat my Undertaking, very much beyond the Sum I contracted for with the Trustees; which, without I am relieved in, I must be liable to continual Actions and Imprisonment, and debarr'd from any further Industry the future part of my Life: Therefore I hope the Honourable the Trustees, in their Justice to me, will now please to remember their Promise, or Agreement with me, upon my entering into Contract with them for Twenty-five Thousand Pounds, That in case I did effect the Work, and that the said Sum should by means of any unforeseen Accidents, prove deficient, they would recommend me to the Honourable House of Commons, to be reimbursed such Money as my Contract should fall short of, and for such a Reward to myself as the House should please to order.

IF I may (now the Work is compleated, and so many Years spent therein) be but freed from the Debts and Engagements into which it has plung'd me, and set at liberty to offer myself upon some other Work, whereby I may be of use to my Country, and have Opportunity of getting my Bread; I shall chearfully submit to
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whatsoever shall be thought fit, as to any Consideration or Reward to myself.

A Foreign Minister residing at this Court, has lately received Orders from his Master, to take my Opinion about a particular Service, propos'd to be of Benefit to his Dominions; and the said Minister, upon my Answer return'd thereto, assur'd me of suitable Encouragement, if I will go thither.

I have, in the foregoing Pages, made mention of my having view'd the Ports of *Dublin* and *Dover*, and shall be glad if the Service which I have propos'd for either of those Places may be acceptable.

As to the first of which, there having been no Experiment, as I know of, yet practis'd in the World with tolerable Success, for the Relief of Bar Places, which are known to be attended with frequent Misfortunes and Misery; and being well satisfied, that what I have to offer, particularly with relation to the Bar of *Dublin*, (which is not a shifting Bar) may be depended to be made to such a Depth as I have propos'd to that City, and when once fix'd, maintain'd with very small Trouble and Expence for Thousands of Years to come: And I should be very glad if I might have the Opportunity of showing an Instance of such Service, if that City should now revive the Thoughts of it; and

and in case the same may be esteem'd of any Consequence for Cruising Ships in the time of War, I am ready (if requir'd) to submit the Scheme which I have by me, to be examined by such Persons of Judgment as may be thought proper.

Secondly, As to the Method hereafter transcribed, relating to the Port of *Dover*; I have since my Delivery of it to the late Lord *Aylmer* been inform'd, that the same thing, or to the like effect, as to the first part of what I propos'd for preventing the rolling of the Beach from choaking up the Entrance into the Peer, was recommended to some Gentlemen of the Town, by Mr. *Acworth*, present Surveyor of his Majesty's Navy, before my going thither; and the Means which they have since used, have been so effectual, that they now stand in no Apprehension of the Mouth or Entrance into the Peer, being any more choak'd up by the Beach that has annoy'd them; and Beacons (or Marks) in nature as I propos'd, for Ships to run in by Day, and Lights by Night, at the proper Time of the Tide for it, have been set up according to the Publication made in the Gazette, in the Months of *October* and *November* last.

WHEN I was at that Port, the Commissioners (or Trustees) appointed by Act of Parliament, acquainted me with the
 Surveys

Surveys which had been made, and Endeavours us'd, beginning from the great Sir *Walter Raleigh*, until the making of my View in the Year 1718; and as nothing hath been yet done, nor no Proposal before been offer'd for rendring that Port commodious for Entertainment of large Ships to go in and out, and to lie a-float with their Lading: So I humbly submit what I have propos'd, whether it be not the only possible Method for it, and worthy of Consideration to be put in practice for the Publick. And as, in my Opinion, by reason of the Nature of the Ground, the chief Difficulty will be in fixing the Foundation (or Apron) of the Sluice, for making the Basen propos'd, to such a Depth as may be required for rendring the Port commodious for Men of War, as well as Merchant-Men; so I shall be very glad of the Honour, if I may be assisting in it.

A Copy of which is as follows:

T O

T O

The Right Honourable

The Lord *AYLMER*.

My LORD,

IN Obedience to your LORDSHIP'S Commands, I have been lately down, and carefully survey'd the Port of *Dover*; and, to the end that the Observations which I have made, and what I shall propose for the Amendment of that Harbour, may be the better apprehended, I shall first take notice of the Inconveniences and Disadvantages that now attend it, together with the Deficiency in all the Designs or Attempts hitherto made to remedy the same.

THE first great Evil, which is complain'd of, and known to attend that Harbour, is, that when the Wind blows hard from the Sea, towards the South and South West,

West, it causes a great Drift of the Ballast or Shingle to sett along the Shore, which lodges before the Peer, and choaks up the Mouth of the Harbour, so that no Ships or Vessels can enter, until the Wind, or Weather changes; and that there is Time and Opportunity to clear the Mouth of the Harbour, by the Methods they now practise for it: and though this does not happen so often as is reported, yet the very Notion and Apprehension of it deters Men (especially when the Wind blows any thing strong from the Sea) from attempting to put into a Port, where they are not certain of the true Depth of Water at the Entrance, to bring them into Safety.

THE next observable Inconveniences or Disadvantages which attend that Harbour, are these; *First*, That the Water ebbs away every Tide, and leaves the large Space between the Mouth of the Peer, and Dam, or Cross Wall, (as they call it) belonging to the Bason, for the most part wholly dry. *Secondly*, That there is now ordinarily not above ten foot Water over the Apron, or Cell of the Gates, belonging to the Entrance into the Bason upon a Neap Tide. *Thirdly*, That there is much less Water within in the Bason, than there is at the Entrance, ex-

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cept it be for a small Space near to the Gates. *Fourthly*, Although there were a better Depth of Water possible to be made, yet there is so little room in the present Basin, that it is generally pretty well filled with lesser Vessels, and not capable of entertaining both them and any considerable Fleet of others. *Fifthly*, The Dam, or Cross Wall, is so injudiciously made, that the Water cannot be penn'd up in the Basin to any considerable height above the Neap Tides: And when there happens to be any occasion for scouring away the Beach, from the Mouth of the Peer, the Water is then usually let wholly off, or the greatest Part of it, and all, or most of the Ships in the Basin, left dry on the Ground. *Sixthly*, There is only one single Pair of Gates made for the Entrance of Ships; so that if any Ship or Vessel whatsoever has a mind to come into the Basin, when the Water is ebb'd but an Inch below the height that it is penn'd up to, it is impossible to open the Gates, to let any Vessel whatsoever into the Basin; inasmuch, that the Ships, which the Basin is now capable of entertaining, if they judge the Water to be fallen, must either take Care not to come at all into the Port, or be obliged to lie a-Ground without the Basin, in the Space between that and the Peer before mentioned. So that

that through these several Inconveniences it is, that no Ships of large Burthen, and but very few of lesser Depth of Water, in comparison of what the Harbour is easily capable of being improv'd to, can now practise the coming in and out of the Port, with the Convenience of having room enough when they are within, and of being sure, to lie always a-float with their Burthens. And it is a Thing, no doubt, well known to your Lordship, that all Masters or Commanders of Ships, particularly those who use the Southern Trade, whether outward or homeward bound, are very careful, when they are laden, not to come near the Ground, or willingly to come into any Place, where there is any Danger of the Waters ebbing away from them, lest they should strain and damnify their Ships, more especially such as are sharp and built for Sailing: And that likewise the same Regard ought to be had for Ships of War, to take Care not to come any where to lie on the Ground, until their Ships are lighten'd, and they are sure of a proper Place to take no Damage in.

HAVING thus mention'd the several Disadvantages which attend this Harbour, I shall now offer my humble Opinion for the Remedy thereof. And first as to the Obstruction at the Entrance into the Peer,

occasion'd by the Drift or Rolling of the Beach or Shingle along the Shore; what I would propose is, *First*, to make several low narrow Jetties, (or Break-Waters) extending from the top of the Beach down to the Low Water Mark, upon the same Descent or Slant as the Beach lies, and not above two or three foot height above the Surface of the Beach, to be built as well to the Eastward, as to the Westward of the Peer, as far as the Town extends; which low-built Jetties will require no great Charge to be made, and afterwards to maintain in Repair.

THE next Thing I propose, is, in a more strong and effectual Manner to carry out the Peer, on the West Side of the Entrance, into the Harbour, at least 150, or 200 foot farther into the Sea, than has ever yet been done, extending more into deep Water, and into the stronger Course of the Current, as it sets along the Shore. As to the Eastermost Peer, I would not carry that much farther, or rather let it remain as it is, until Time shall shew the Practice of running in and out with one Peer only; which, I believe, will be sufficient for it, there being not know'n any Beach to annoy or choak the Harbour by any Drift from the Eastward; which, as I remember, I was inform'd by the Pilots belonging to the Port:
and,

and, when there is only one Peer carry'd out, it will, as I take it, be the less dangerous for Ships, which have been known to suffer by their missing the Entrance, and being cast, by the Force of the Tide, against the East Peer. But if the Westward Peer be made of a greater length, and a Ship, when the Wind hangs Westwardly, by the Force of the Tide that runs thwart the Peer, should be thrown a little too much to the Eastward, that she cannot luff up again, when the Wind hangs Westward, as aforesaid, she may instantly let go her Anchor; or, if Warps with Buoys, for that Purpose, are fixed at proper Places, Ships may, by taking hold of them, easily warp in or out under the Slack or Eddy of the Peer, the Course of the Tide along the Coast being known always to set to the Eastward, from the half Flood to half Ebb; and that Ships may, with more Conveniency, take hold of such Buoys, they may have Hooks fixed to the Strap, to receive the Bite of a Rope, being cast from any Ship. And a farther Reason why I propose a single Peer, for the present, to be carry'd out to such Distance, is, that I believe the Harbour will be thereby freed from being choaked up any more for ever, by the Means of any Drift of the Beach. But as I shall hereafter propose a much larger

Quantity of Water to be penn'd up in the Harbour, than has ever yet been ; so, if ever it should happen, that a small Matter of Beach should at any time lodge, it will be much easier to spare Water for the scowering it away ; and the Observations which I ground my Opinion upon, are these that follow,

I HAVE been inform'd, both by the Commissioners, whom I had the Honour to wait on at *Dover*, and by many of the Pilots, as well as by Gentlemen of Understanding, Inhabitants of the Town, that some Years since, within their Memory, there fell down a Clift of Chalk, of Rocks, some Distance to the Westward of the Town ; and, by its Fall, shot itself into the Sea, and lay upon a Slant above the Surface of the Beach, from High to Low Water Mark, by which Accident, the Beach became wholly stopp'd for many Years from driving along the Coast, and during all such time the Mouth of the Harbour was entirely free from being choak'd up, until the Beach, by means of the said Clift lying far to the Westward, began to wear quite away from before the Town ; and the Inhabitants thereupon became apprehensive, that there was Danger of the Sea's washing away, not only the Beach, (which there was no small Jetties made to support and prevent) but
even

even of wearing away the Bank, and breaking through the Walls of the Basin: they therefore, through this Apprehension, blew up and levell'd the said Clift, and let the Beach come on again to the Harbour's Mouth, as before, and which now lies under the Disadvantage of being frequently choaked up thereby:

ANOTHER Instance of the same kind, which I was also inform'd of, is, That there lately happen'd another Clift to fall down into the Sea to the Eastward, just under the Foot of the Castle, which continued several Years to lie above the Surface of the Beach: and that it was very remarkable, the Beach was thereby wholly stopp'd from being driven at all to the Eastward, but gather'd and lodged wholly between the said fallen Clift and the Mouth of the Peer, until the Clift, by the Operation of the Waves of the Sea, was wash'd and worn level, or equal with the Surface of the Beach; and that the Beach, in bad Weather, now wears away again from out of the Bay to the Eastward of the Peer, and rolls on towards the South Foreland, as it did before.

THESE two Instances of Accidental Causes which have happen'd, I think may give sufficient ground for a strong Presumption that if an Artificial Jetty be built out to a further distance than what

was occasion'd by either of the aforesaid Accidents, no Beach will pass the same so as to subject the Entrance of the Harbour to any Annoyance thereby; especially if low snug Jetties or Break-waters are built in two or three places to the West of the Peer, and five or six to the Eastward, extending near as far as the foot of the Castle: which small Jetties may be easily made with no very great Charge in the doing. And there may likewise be a small Foot-work made at the Low-water Mark to the Eastward of the Peer, the better to preserve the Beach from being washed away, that now lies in the Bay a considerable distance from the Shore up as high as the High-water Mark; but as I remember, there is none appears at Low Water, so that the Ground there is free and convenient for the making of such a small Foot-work, if there should prove any Occasion.

THE next thing which I shall propose, that Ships may be both certain to have a better Depth of Water when they come into the Harbour, and to lie always afloat with their Burthens, is as follows,

A little within the Mouth of the Peer, as is laid down by the pricked Line in the Draught, there to make a Dám for the penning up the Water to the ordinary Height of the Spring-Tides, and to fix down a large Sluice with double Gates for the

the Entrance of Ships into the Basin: for which purpose I propose the Apron to be placed about three or three foot and a half deeper than the Apron of the present Gates: that are fixed in the Cross-Wall or Dam, at Letter *C.* in the Draught.

AND the Reason why such Sluice ought to be made with double Gates, one Pair at a proper distance without the other, is to the end, that all Vessels whatsoever, as well before as after High Water, or at the lowest Neap Tides, whenever they have Depth enough to come in within the Mouth of the Peer, and to enter upon the Apron of the first Pair of Gates, that then they may by the Practice of raising and lowering the Water in the Space between the two Pair of Gates, pass in or out of the Basin at pleasure, altho there be several foot difference of Level between the Height of the Water in the Basin and that in the Sea; for the Water within in the Basin must be constantly kept up to the necessary Height, that Ships when they come in within the Basin may lie afloat, and not have the Water ebb'd away from them: which Method of double Gates is what was lately made at *Mardyke*, and is the only commodious and proper Way known in the World, for the Practice of receiving Ships or Vessels in and out, of either any Natural or Artificial

cial Basin, where there is not otherwise Water enough for the Conveniency of Ships to lie afloat, but by the being pent up by Sluices.

AND for the Purpose of entertaining any Considerable Number of great Ships, so that they may, particularly in the Winter-Season, when they are outward bound, and the Wind hangs contrary, gladly chuse this for a Place of Safety as much preferable to the *Downes*, where so many Ships with their Cargoes, which are known frequently to be driven from their Anchors, have been lost, and Mens Lives perished with them; but in this place Ships may both lie perfectly safe, and be in equal readiness to put to Sea when the Wind presents fair for it. In which case I do not know that they will be under any disadvantage of putting to Sea; but when the Wind happens to be about East-South-East; and then if it be any thing of tolerable Weather, they may also easily put to Sea, by the help only of a Warp to an Anchor for that purpose, laid right out from the Head of the Peer; and when it blows hard about the East-South-East, even Ships which ride in the *Downes* are seldom known to attempt putting to Sea.

AND to the end there may be sufficient room for the Entertainment of Ships in this Harbour, it will be necessary at the same

same time when the Sluice shall be made, to level and cleanse all the Space at Letter B. which will remain between the new Dam which I propose and the Cross-Wall belonging to the present Bason: which place alone I believe will then contain upwards of seventy Sail of Ships, from about 14 to 17 foot Draught of Water, and do believe that the present Bason when also deepen'd and cleans'd equal to the Level of the Apron of the present Gates, (which are to be broke down and taken away) and that the Water shall afterwards be constantly pent up by the help of the New Dam and Sluice to the Height of the common Spring-Tides; That then about sixty Sail of Ships drawing from 10 to 14 foot Draught of Water may be entertain'd in this place: and for other smaller Ships and Vessels, a sufficient place may without any great Charge be made either at Letter N, or at the Letter K, or place called the upper Pent in the Draught laid down.

SHIPS of 14 or 15 foot Draught of Water is what I propose to run in and out in the ordinary Course of the Neap, or between the Spring and the Neap Tides, without being pinched for want of Water in the Harbour; but at the top of the Spring-Tides such Friggots as may be appointed to clean or refit, as well as other Ships
from

from 15 to 17 foot Draught of Water and upwards, may then very safely go in or out.

AND those Ships before named of lesser Burthen, drawing 14 and 15 foot, they may at the time of Spring-Tides depend upon the going in and out of the Port with their Lading, upwards of an hour and a quarter before, and near an hour after High Water: As also for the Practice of smaller Ships, those of 13 foot Draught of Water may, at Spring-Tides go in an hour and minutes, those of 12 an hour and minutes, those of 11 an hour and minutes, those of 10 an hour and minutes before, and about two thirds as much time after High Water. And the Difference between the time of Entrance upon the Neap Tides will, I believe, ordinarily not prove above three quarters of an hour less: and for all lesser Ships and Vessels, they will in proportion to the Depth of Water which they draw, have always the more time both before and after High Water for their passing either in or out of the Bason. Also there will be a small Space left without the Bason to entertain such Ships or Vessels, which are not apprehensive of suffering any Damage from lying on the ground, or that purposely chuse it, to clean or refit, for which Use there may be a proper Place made for Ships without the Bason, as well as Convenience

ence to be made for careening of Ships within the Bason ; and where also a Place may be found for making of a dry Dock, if thought fit.

Lastly, IN case of such Works and Bason being made as above propos'd, for the better Certainty and Guide for Ships coming in and out of the Port, it will then be necessary that a more exact and regular Calculation should be made and publish'd to the World, for every Day of the Moon's Age, the Depth of Water which shall by such Computation be reckon'd to be upon the Apron of the Sluice, the Hour and Minute of the Day, as well upon the Flood as the Ebb ; so that Ships may be thereby able to make sure and sufficient Allowance for the time of their running in, when, perhaps they may be obliged to it without a Pilot ; and for which Purpose, in case of Extremity of Weather, when it may be difficult for Pilots to come off, proper Beacons may be set up, so that Ships, especially that are any thing acquainted, may venture to run in without a Pilot : and Lights also, if thought fit, may be set up for the coming in by Night, when fair Weather may make it practicable to do it.

THUS, my Lord, I have laid down my humble Opinion of the Improvements this Harbour is capable of, the Performance of
which

which will not only prove advantageous and agreeable to such Ships as shall pass this Way, but extend to the common Benefit of the Kingdom in general.

For it very often happening that Ships are obliged to lie a Month or six Weeks Wind-bound in the *Dowries*, besides the common Wear and Loss of their Ground-Tackle, it is too well known that there is more Riches frequently lost in one Storm by Merchant-Ships being driven from their Anchors in the *Dowries*, than would make this a common Place of Safety for a very considerable Number of such Ships.

AND your Lordship can best judge how great an Expence would be saved, and what Advantage would accrue in Time of War; by making this a Port convenient for Cruizing Ships.

THE Charge of doing this Work, tho by reason of my Business requiring me in another Place, I had too short a time in taking my View, to make my Computation to any Exactness; yet, I do believe it may be depended upon not to exceed the Sum of Thirty, or Five and Thirty Thousand Pounds, especially if the Stone in and about *Dover-Castle*, which is not any way of use there, be order'd to be employ'd in the Performance of this Work.

SUB-

SUBMITTING the whole to your Lordship's Judgment and Favour, I remain, with my utmost Duty,

My LORD,

Novemb. 1718.

Your Lordship's Most Obedient,

And Most humble Servant

J. PERRY,

This Report or Proposal for the bettering of the Port of Dover, I found amongst my Father's Papers, since his Death, signed by Captain Perry; which, at his Request, I have return'd to him this 12th of October, 1720.

A Y L M E R

As

An ABSTRACT of the Indenture of Covenants for the stopping of Dagenham-Breach, made between the Right Honourable the Trustees, appointed by Act of Parliament for that Purpose, of the one part, and Captain John Perry, of the other part, bearing Date the 26th Day of January, 1715.

Captain *Perry* covenants, That in Consideration of 25000 *l.* covenanted to be paid to him in the Manner as in the said Indenture is mentioned, he will before the 1st of *November*, 1717, effectually make up, and stop the Breach, in the Levels of *Havering* and *Dagenham*, being of the Width of 400 Foot; and repair and make good the Walls, Banks, and other Works, so that after stopping the Breach and the Tides shut out of the Levels, upon a View at any time to be appointed, there shall not be observed any Leakage thro the Dam, occasioned by the Pressure of the highest Tides, so as to swell or raise the Water on the Inside of the Creek (or Works) the fourth part of an Inch, which View shall be taken by 15 Trustees, 10 (of whom not more than 5 shall be Landowners) to be nominated by the Trustees at their general Meeting, and the other 5 by the said *Perry*.

THAT

THAT he will before the said 1st of *November*, repair with good Scarfing the Walls or Banks belonging to the Levels; for 200 Yards on each side of the Breach, so, and in such manner, as to prevent the *Thames* for 3 Years, after stopping the Breach, from breaking into and overflowing the Levels, by reason of any Defect of the Walls or Banks of the same, by all the Length or Space aforesaid.

THAT in case he shall think it necessary, in order to the more speedy stopping the Breach, to make any new Cut or Cuts in the Walls or Banks, that then he shall within Six Months from the time of stopping the Breach, make good such Cut or Cuts, in such manner as to prevent the *Thames*, for Fifteen Months, from the time of repairing the Cut or Cuts, from breaking in and overflowing the Levels, by reason of any Defect, in that part of the Wall, wherein such Cut or Cuts shall be made.

THAT before the said First of *November*, or within Six Months after stopping the Breach, he shall make, and fix a sufficient Sluice, to the Satisfaction of 15 Trustees appointed as aforesaid, or the major Part of them, so as the same be not more than one Foot lower than the old Sluice in *Haverling* Level, for the draining and carrying off the Back-Waters from the said Levels:

THAT he shall before the said 1st of *November*, well and sufficiently repair and amend all the said Walls and Banks, from *Rainham-Creek*, to the half-way Tree, and maintain the same for 15 Months after the Breach is stopp'd, in such effectual manner, that the Tides shall not break into and overflow the Levels by reason of any Defect or Imperfection in the Walls, by all the Length and Space aforesaid; and also, that the Walls shall be made of the full Height as the opposite Walls of the Levels on the other side of the *Thames*, or of the same Height with the Walls of the Levels next above Westward, or next below Eastward, to the Levels, in the Judgment of 15 Trustees appointed as aforesaid, or the major Part of them.

THAT he shall forthwith, after stopping the Breach, begin to work upon the Sand-Bank without the Mouth of the Breach, in order to remove it, and shall within 18 Months, to commence from the 23^d of *April*, 1718, remove the said Sand-Bank, so that the Water shall be full six Foot deep at Low-Water Mark, at a Neap Tide, in the Judgment of 15 Trustees, chosen as aforesaid, or the major Part of them; so as they do view the same, within 40 Days next after he shall give notice, that the said Sand-Bank is removed.

THE

THE Trustees covenant to pay Captain *Perry* in the whole 25000*l.* as follows, *viz.* not more than 15000*l.* before stopping at Low-water, and 6000*l.* more within 30 Days after he shall have stopped the Breach, and turn'd the Tides out of the Levels, according to his Contract, upon his becoming bound at the Receipt of every Part thereof, by Bond with one or more Sureties to be approv'd by the Trustees, for Repayment of all such Money as he shall receive, in case he shall not perform the several Parts of his Contract, namely, the maintaining the Walls from *Rainham-Creek* to half-way Tree, for the Space of 15 Months, and the Breach itself and Walls for 200 Yards adjacent, for the Space of 3 Years next after stopping the Breach, and a View and Report made thereof by 15 of the Trustees chosen in manner aforesaid; or in case of Accidents, do not make good the Damage: and the remaining 4000*l.* within 30 Days after Removal of the Sand-Bank.

THAT the Security Bonds shall be deliver'd up to be cancell'd, when the Conditions are perform'd.

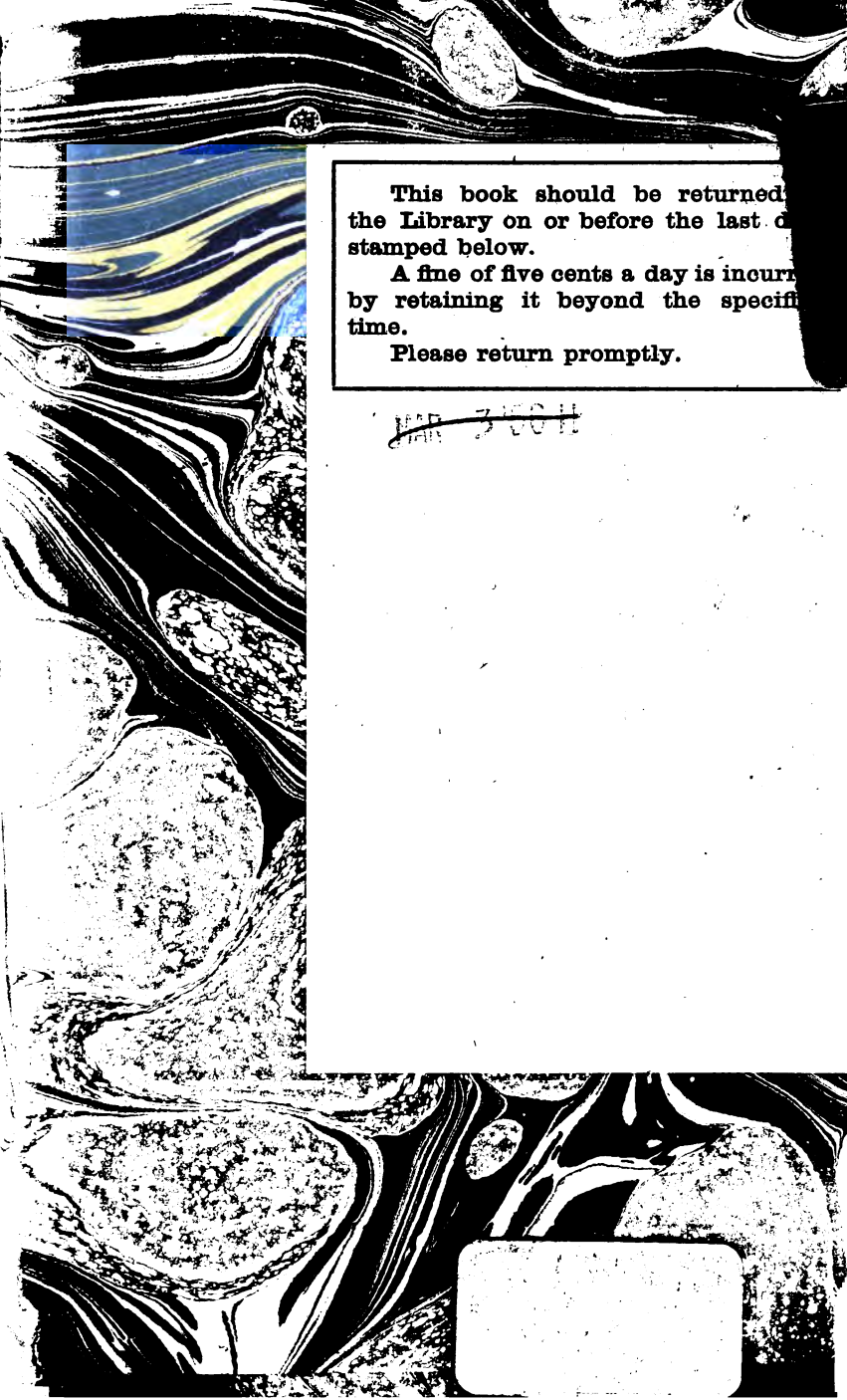
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